RADIO and ELECTRICAL Review

TELEVISION - COMMUNICATIONS - SERVICE - SOUND

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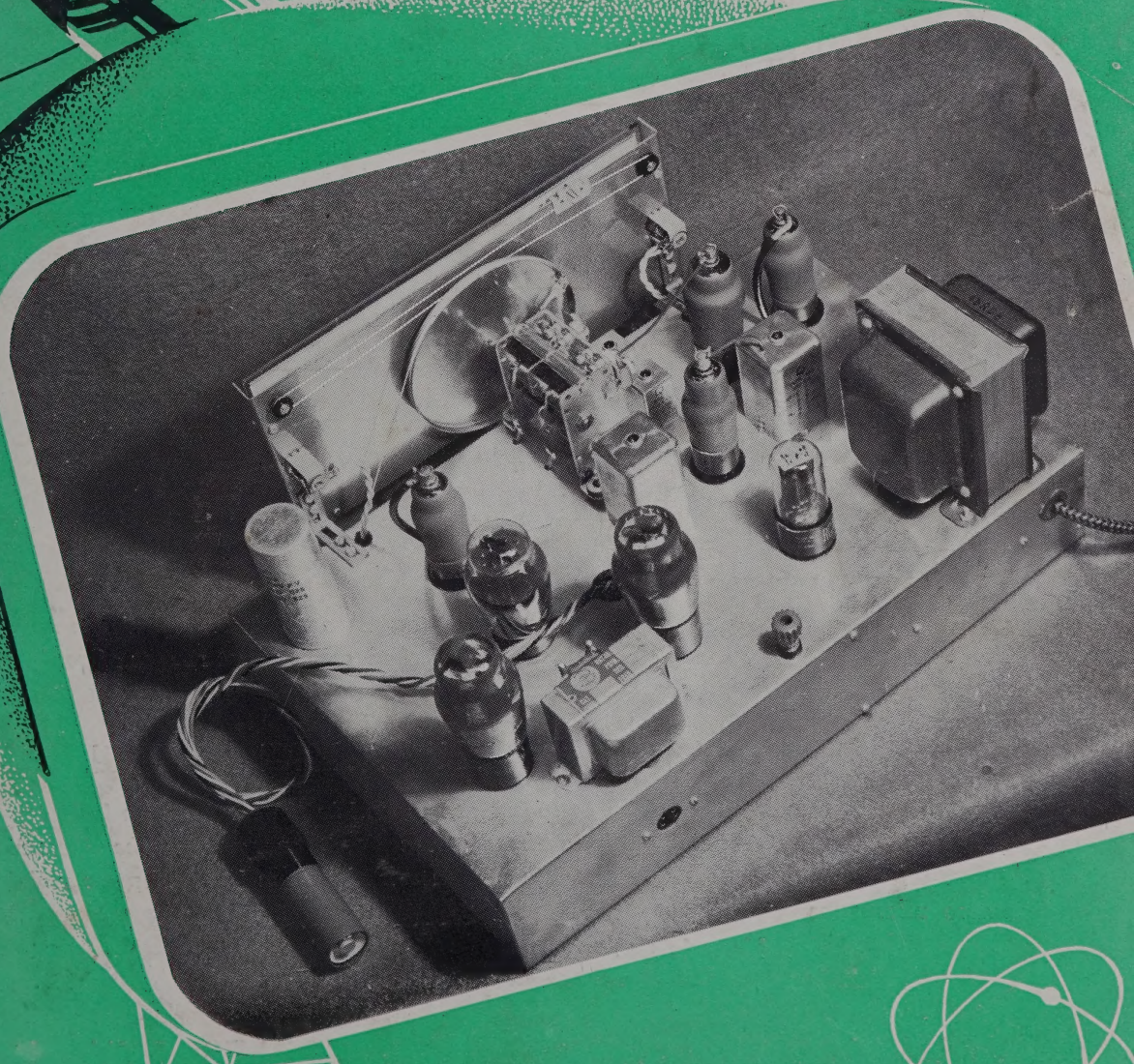

JULY 1st, 1956

VOL. 11, NO. 5

PRICE 1/10

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Radio and Electrical Review

OUR COVER PICTURE this month shows the top chassis view of the "R. & E." 8-Valve Radiogram described on pages 20 to 24.

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VOL. 11, No. 5 JULY 1st, 1956

Contents

Sole New Zealand Distributors: Gordon & Gotch (N.Z.) Ltd., Wellington

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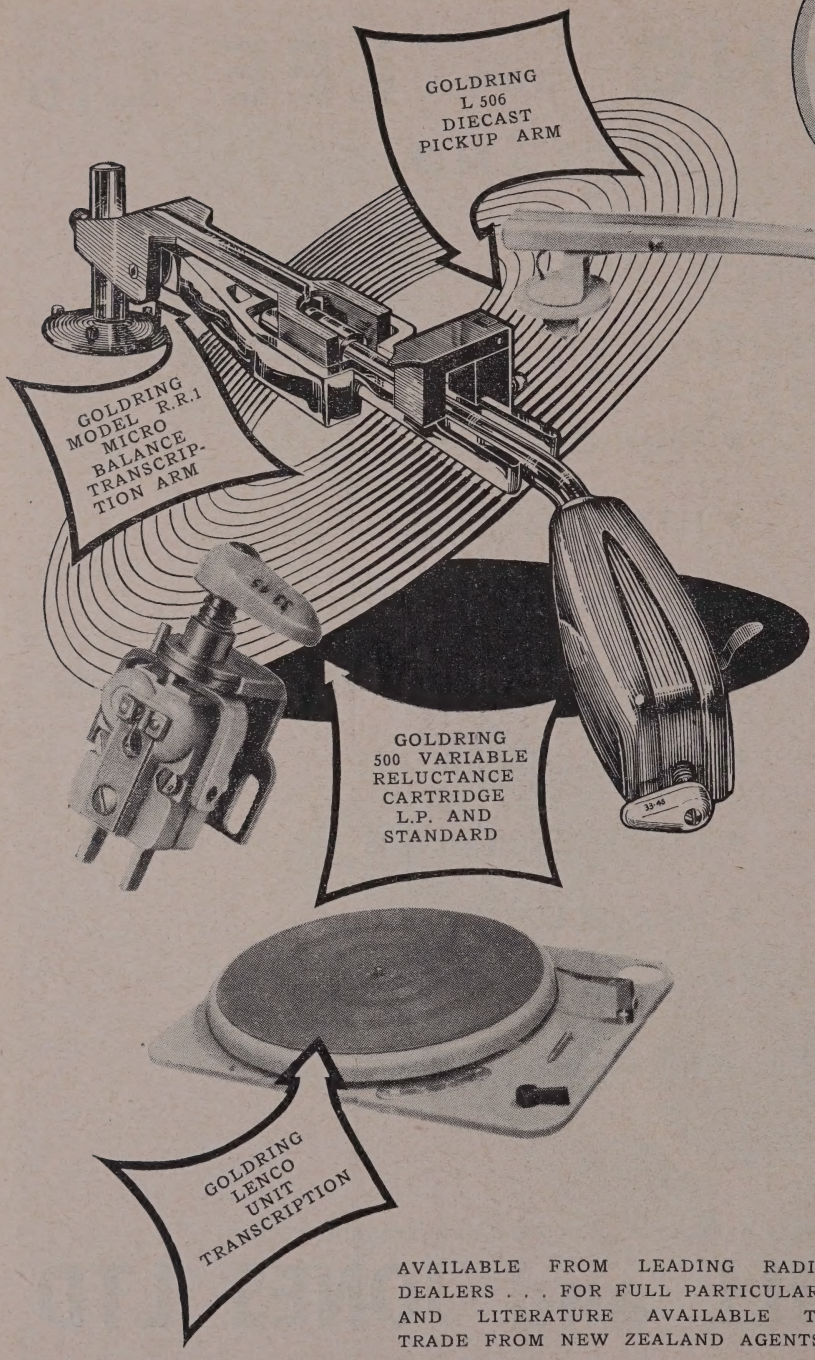
TEE VEE RADIO LTD.

APPOINTED NEW ZEALAND AGENTS FOR—



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TRANSCRIPTION UNIT
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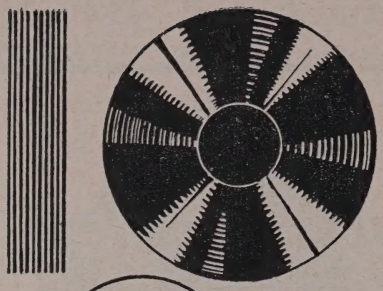

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'MAGIDISK' AUTOMATICALLY SELECTS 7", 10" OR 12" DISCS

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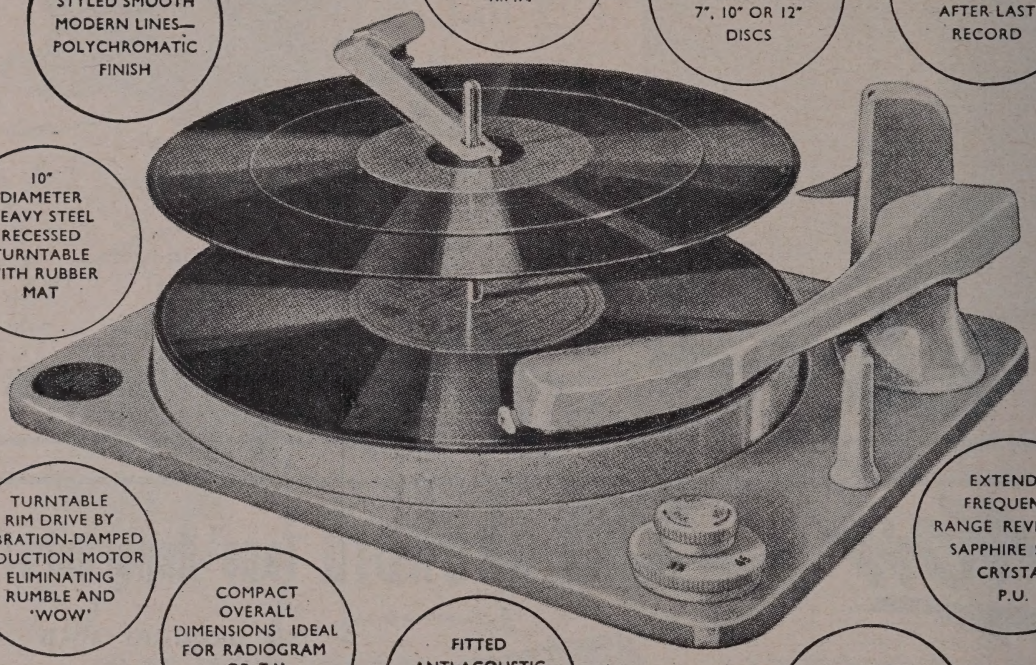

10" DIAMETER HEAVY STEEL RECESSED TURNTABLE WITH RUBBER MAT

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COMPACT OVERALL DIMENSIONS IDEAL FOR RADIOGRAM OR T.V. CONSOLE

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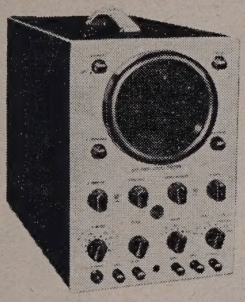
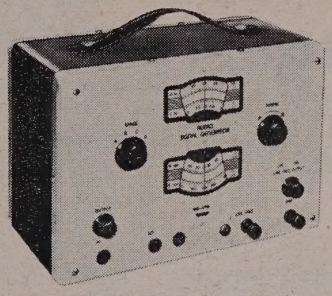


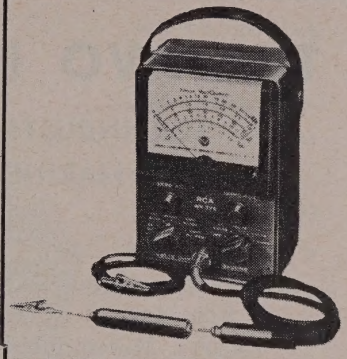
5 in. OSCILLOSCOPE WO-88A

Built in voltage calibrating facilities permit simultaneous wave shape display and peak-to-peak voltage measurements. Sync polarity instantly reversible via front panel switch. Matched high impedance probe provides overall input resistance of 10 megohms and input capacitance of not less than 10 mmfd. Response is flat within —3 db from 0–500 Kc, useful to 1.0 Mc.



AUDIO SIGNAL GENERATOR WA-44A

Excellent for use in measuring impedances of amplifiers; resonant intermodulation distortion in frequency response; input and output frequency of loudspeakers; and speed of recorder/reproducer mechanisms, etc. The WA-44A features a new RC-type oscillator having wide frequency range and an amplified agc circuit ensures an output within ± 1 db over the entire frequency range.

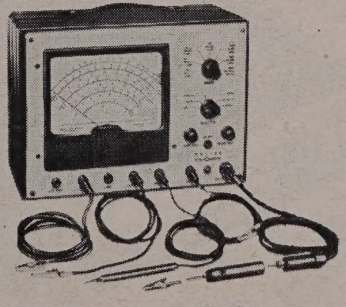


JUNIOR VOLTOHMYST WV-77A

Unquestionably the greatest value in all-electronic AC-operated vacuum-tube voltohmmeters. Features include: High-input resistance, low-input capacitance on DC functions, ability to measure DC in the presence of AC and vice versa, burn-out-proof meter circuit, ± 1% multiplier resistors, DC polarity reversing switch, negative feedback bridge circuit, etc. Plus wide frequency response and extended voltage ranges.

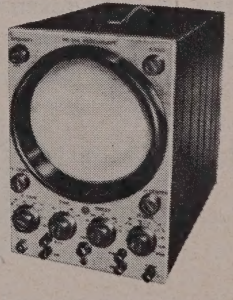
SENIOR VOLTOHMYST WV-97A

Contains full-wave signal rectifier for direct readings of peak-to-peak voltages up to 4200 volts. Measures DC voltage from 0.02 volts to 1500 volts with accuracy of ± 3% of full scale. Has 11 megohm input resistance, electronic protection against meter burn-out, zero-centre scale, rugged 200-microampere meter movement, ± 1% multiplier resistors.



MASTER VOLTOHMYST WV-87A

Featuring a 7½ in. meter, the WV-87A measures DC voltages accurately in high-impedance circuits, even with AC present. It also reads rms values of sine waves and the peak-to-peak values of complex waves or recurrent pulses, even in the presence of DC. Other features include: ± 1% multiplier and shunt resistors, a ± 2% meter movement, DC polarity reversing switch, etc. Accurate and stable enough for many laboratory applications.



7 in. OSCILLOSCOPE WO-56A

7 in. screen plus trace expansion of 3 times screen diameter provide unusually large wave-shape display for distant viewing or examination of minute portion of wave shapes. Identical frequency and phase characteristics of both the V and H amplifiers make the WO-56A invaluable for phase measurements. Frequency compensated and voltage calibrated attenuators on both amplifiers. Response is flat within —2 db from DC to 500 Kc, within —6 db at 1 Mc.

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- ★ Powered by three high-grade recording motors, giving fast forward run and rewind without unlacing tape.
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- ★ Positive servo braking.
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- ★ Instantaneous Braking. Automatic erasure.
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- ★ Tape timing index.

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DOMESTIC LOUDSPEAKERS

The loudspeaker enclosures in this new range are designed to take full advantage of the outstanding performance of Tannoy Dual Concentric Loudspeaker Units. For the first time the dual-throated port principle is employed, marking a notable advance on the more orthodox type of reflex cabinet. Both corner and side-wall models make optimum use of the additional acoustic loading offered by walls and floor. Styling is modern but restrained and a wide range of carefully chosen veneers is available to blend with any furnishing scheme. Cabinets are hand-polished and fitted with tygan plastic fabric coverings—acoustically superior to cloth or metal, and easily cleaned with a damp sponge.

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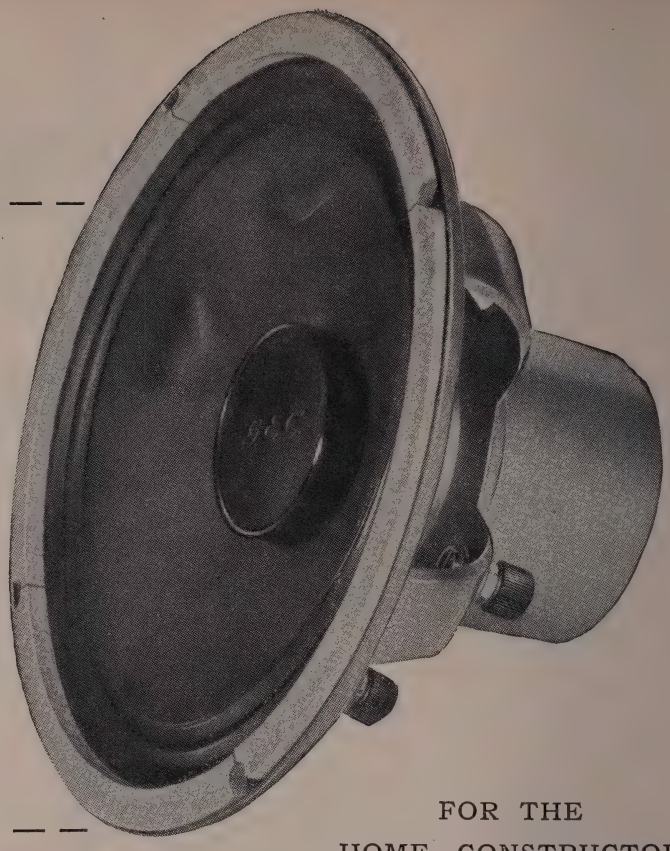
9 Octave

realism...

from a single unit



The G.E.C. metal cone loudspeaker gives lifelike reproduction of any type of sound over a range of 9 octaves. This includes the entire musical fundamental range together with overtones which give tonal quality and character to the performance of each musical instrument.

The sound engineer will appreciate the simplification and improvement in performance which has been achieved by combining the following attributes in a single unit.

- **Smooth response over a range of nine octaves with extremely good low frequency response**
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FOR THE HOME CONSTRUCTOR

This is a professional instrument and must be used under the correct conditions to obtain the optimum results. A cabinet has been designed for use with this speaker, details of which are contained in the Osram 912 Plus Book.

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G.E.C.

METAL CONE LOUDSPEAKER

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Single-hole fixing; 40 adjustment for vertical mounting on curved or sloping surfaces.

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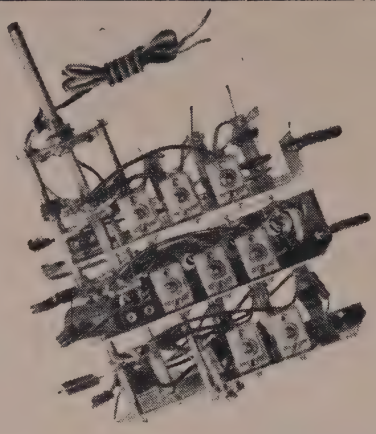
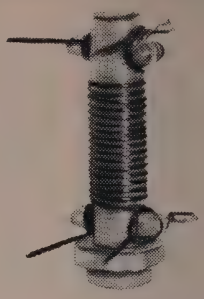


Poly-Q

COIL–ASSEMBLIES



Polystyrene low-loss coils throughout—adjustable iron-core slugs—fixed padders —oscillator plate tuned—temperature compensated on short-wave—A.V.C. time constant reduced on short-wave—converter ECH21—simply modified for ECH35—air tested and aligned—full instructions and circuit diagrams—easy to align—gang—dial—chassis to match.

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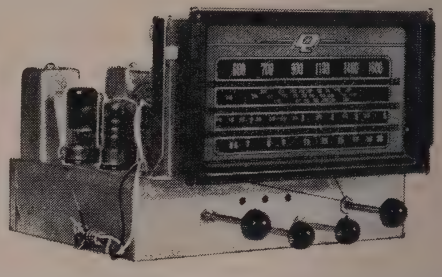

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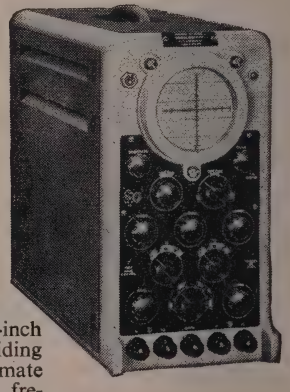

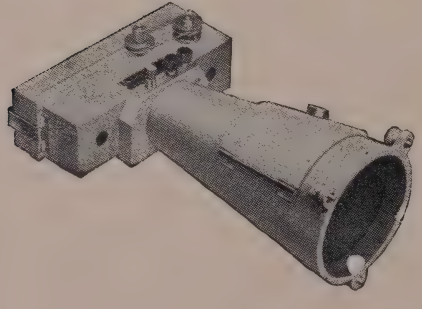

MODEL 1052 DOUBLE BEAM OSCILLOGRAPH

A new Double Beam general purpose Oscillograph with a 4-inch diameter flat-screen tube, providing two amplifier channels of approximate gain, 2,000 each and an upper frequency response of better than 5 megacycles. The repetitive or triggered time-base has a sweep duration from 200 milliseconds to 5 microseconds with constant full screen deflection.

The Type 1052 Double Beam Oscillograph and mating Camera Type 1432 illustrated are but one unit of the wide range manufactured by Cossor instruments Ltd., England.

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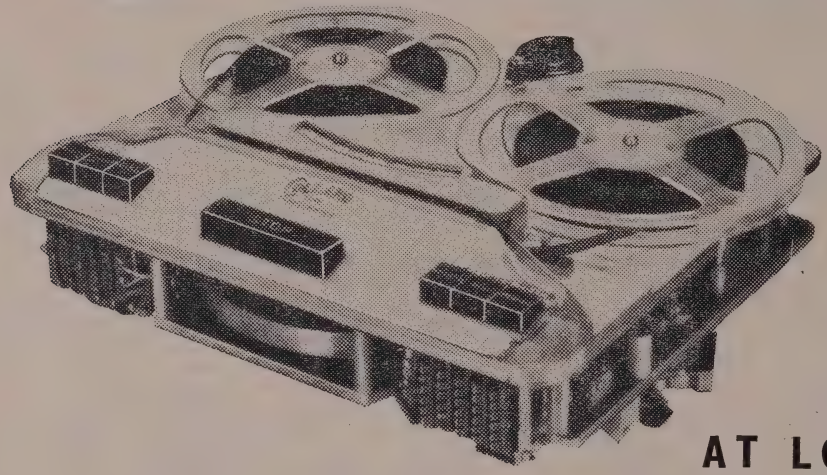

At last!

HIGH FIDELITY AT LOW COST

- At last there is available a reasonably priced High Fidelity High Quality Tape Transcriptor which includes more refinements than incorporated in other Tape Decks. Detailed below are some of its outstanding features:—
- Three-speed . . . Tape speeds of 3¾, 7½ and 15 inches per second.
- Four Heads . . . Two Record/Play-back Heads and two Erase Heads.
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- Constant Tape Tension . . . ensuring that there is constant tape tension on the take-up spool and a constant tension being applied to the tape leaving the capstan.
- Two Motors . . . Each motor only does one job at a time.
- Retractable Drive . . . eliminates flats on the drive pulleys and contributes towards the removal of wow, flutter and rumble.
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- High Fidelity . . . The Heads are double coil wound and will reproduce up to 12,000 c.p.s. at a tape speed of 7½ inches per second. Azimuth adjustment is incorporated on both the record and play-back heads, which are of the High Impedance type, and will have an output in the order of 5 millivolts at 1 KC. at 7½ inches per second.
- Fully mechanical . . . No solenoids or rubber belts are incorporated in the Collaro Tape Transcriptor.
- Finish . . . Cream polystyrene cover plate with maroon controls.

RETAIL PRICE £29/15/-

COLLARO *Low Cost* **TAPE TRANSCRIPTOR**

ENSURES HIGH FIDELITY

Supplies of this amazingly low priced quality deck are bound to be limited by a keen demand — place your order now for first delivery.

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AUTOMATION — A New Catchword

Very few people among the public at large had ever heard of the word "automation" until the recent much-publicized strike in Britain over the dismissal of a number of workers. As a result, it seems to the uninitiated that a new thing has suddenly appeared—a thing, moreover, which many see as a threat to the hard-won status of the worker. One cannot but be reminded of the reception accorded Hargreaves's spinning jenny, and other developments of textile machinery, more than a hundred years ago, for precisely similar reasons! In those days, the factory workers feared that the introduction of mechanical means of doing what had been manual labour would lose them their jobs and reduce them to starvation. Neither they nor many of their employers could foresee that the effect would be exactly the opposite. What happened was that the new machinery reduced the cost of the manufactured articles, and at the same time stepped up the production several-fold, with the result that new markets were opened up which altogether eclipsed the previous ones and enabled the workers who had been displaced by the machines to be employed looking after them, or else in different skilled occupations, such as making the machines themselves.

In a recent talk from the B.B.C., automation was described as a process of setting machines to look after machines, and a little thought shows that this is not such a bad definition. What many people do not realize is that it is not new. What is now called automation has been infiltrating into factories for a very long time, and to some extent the present "flap," if such it may be called, is due to the coining of the new word. If the masses are provided with a catchword, almost anything can happen, as history has amply demonstrated, whereas, if no simple word for a complex process should exist, the effects of the process tend to remain unheralded and to go unnoticed by the populace.

One of the main troubles about catch-phrases is that they are invariably applied loosely and with little relation to any precise meaning they may once have possessed. "Automation" is undoubtedly such a word, and, although it has only just graduated from the stage where the newspapers print it in inverted commas to indicate that it is new and strange, it is already being applied on all sides to processes which can not rightly be called anything more than mechanization. In a very short time, newspapers and all will have reduced the term to a synonym for mechanization. In the meantime, it has been elevated to the status of a bogy with which the semi-educated can be frightened, and this is a very serious matter. Progress will go on, in spite of the dismissals at the Standard factory, and whatever their immediate consequences. Real automation will come to many industries, just as did the spinning jenny that was wrecked by irate mill workers so long ago. No one will deny that its coming will bring problems, but these are a challenge which must be met if Britain is to remain a first-class industrial power.

To some extent, automation is new, but only in the sense that modern development of automatic control equipment has been so rapid that its application on a hitherto unheard-of scale has become possible in the space of a very few years. It is this very quickness of development that brings the problems, not the fundamental character of what has been called the new industrial revolution. One can only sympathize with the dismissed motor-car factory workers, because many of them will have to find different kinds of work, and many will have to uproot themselves and their families and move to where their new work is, but there seems little danger of their becoming permanently unemployed, such is the competition in industry for their services. This fact alone should bring to the trades unions a realization of the true and ultimate effects of automation, and should show them that it is not a bogy to be fought off at all costs, but something which should result in greater prosperity for all, provided its coming is properly handled.

Readers of this journal may be asking themselves what all this has to do with electronics; the answer is, "Everything." If it were not for the tremendous strides made by electronics, automation would not now be taking place, for it is only in the domain of automatic control that our own subject has come into its own. Automation is the direct application to peaceful ends of the exact sort of equipment which, during the last war, was used to enable a radar set, connected through automatic control gear, to track a target automatically and to fire guns at it, after having calculated what allowances should be made for its speed and direction of travel, for the speed and direction of travel of the ship or aircraft carrying the guns, and many other factors. In a sense, therefore, those of our industry who have developed automatic electronic control equipment can be regarded as directly responsible for the "age of automation," as the latter half of the twentieth century may come to be called.

Even in a country like New Zealand, which is predominantly agricultural and pastoral rather than industrial, automation will have its repercussions, not the least of which will be a need for technicians and engineers versed in industrial electronics—the stuff of which automation is made. It behoves us, therefore, to ensure that the radio industry, from which such men should initially come, keeps abreast of modern electronic development, both in theory and practice. We need, and will need increasingly from now on, all the electronic know-how we can acquire.

THE "R. & E." 8-VALVE RADIOGRAM

Following on the extreme popularity of the nine-valve radiogram circuit published in the January, 1956, issue, we have designed an eight-valve circuit which does not possess all the features of the former circuit, but which will probably suit some builders' requirements better. The present circuit is complete with variable tone-controls, fixed record compensation for 78 and L/P, band-expanding I.F. transformers and a high-quality amplifier circuit, but is somewhat simpler and less expensive to build.

INTRODUCTION

We have always known that a good many of our readers are interested in circuits of high-quality radio-gramophone combinations, but we were hardly prepared for the great popularity of the quite ambitious 9-valve circuit that was published in the January, 1956, issue of this journal! This made us think that there would perhaps be a number of builders who would like a combination that would perform all the functions of the previous circuit, but with somewhat less building involved, and costing rather less. Accordingly, we put our editorial thinking-cap on, and have come up with a new design, which is the subject of this article.

FEATURES INCORPORATED

This time, octal based valves have been used, most of which are well-tried and trusty friends. This has been done for the benefit of those who prefer to work with the larger valve bases, finding those of the new noval tubes somewhat fiddly to wire. The push-pull output stage uses KT61s, which were so successful in the "Medium-powered High-quality Amplifier" which was described in these pages some eighteen months ago. A high-gain amplifier and driver system is used, with plenty of negative feedback, so that there is still plenty of gain left after the feedback has had its effect. Independent bass and treble controls are used, together with a separate pre-amplifier valve, with an input circuit suitable for the modern high-quality crystal pick-ups that are proving so popular with audio enthusiasts. On the radio side, the tuner, which covers the broadcast band only, has broad-banded I.F. transformers, with two-point selectivity controlled by the same switch that in other positions arranges the circuit for 78 or L/P records. No R.F. amplifier stage is used, so that the tuner is not so sensitive as the one used in the nine-valve circuit. However, for all but locations where a sensitive tuner is essential, this one will be found to have perfectly adequate sensitivity. It is surprising how little one misses the extra sensitivity conferred by an R.F. stage when a tuner comprising only an oscillator-mixer and a single I.F. stage is well constructed and aligned, so that anyone who may have doubts as to whether such a tuner is sensitive enough need have no fear that he will not obtain good long-range reception.

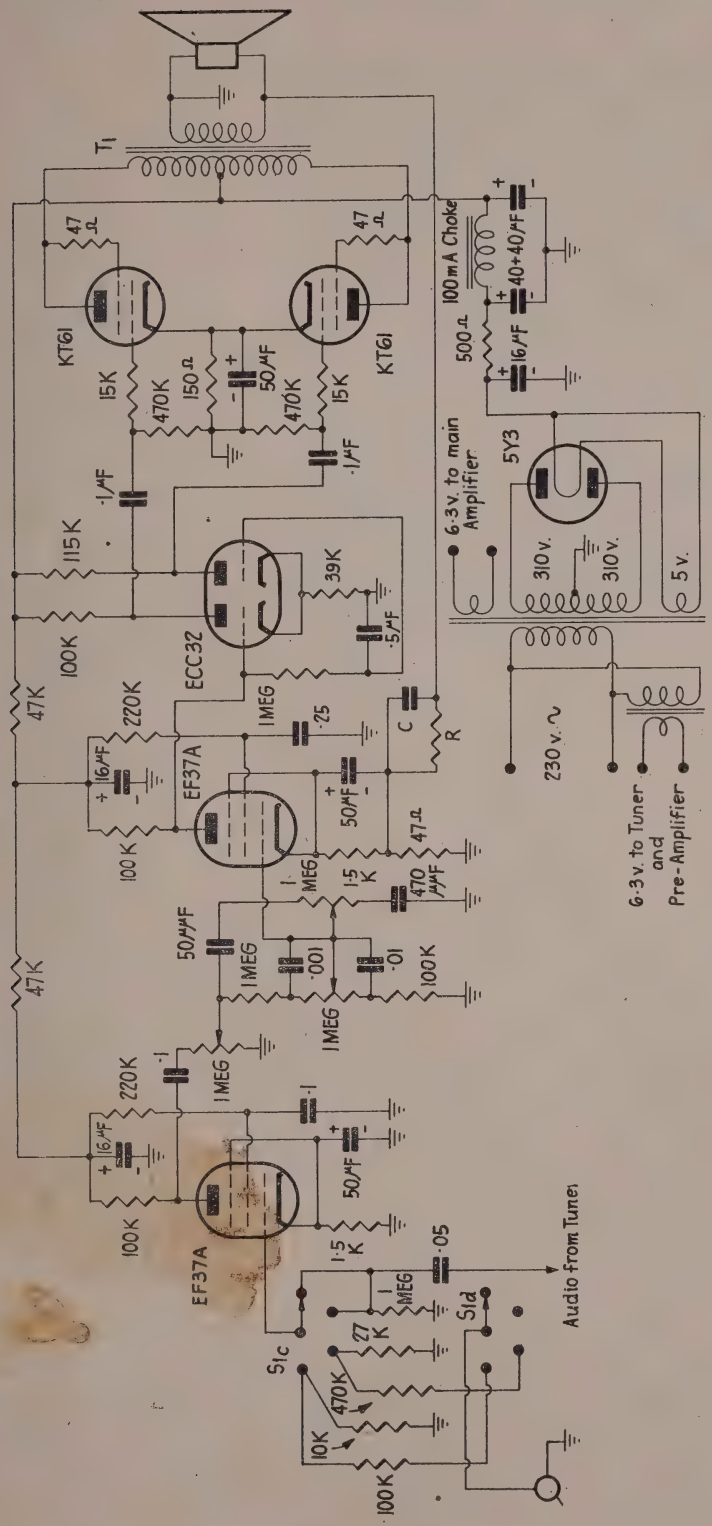
This time, a magic-eye tuning indicator has been incorporated as an extra. It is particularly useful in tuning a set like this, especially when it is to be used by anyone who might leave it somewhat off-tune without its assistance. Most readers will know to whom we are referring!

CIRCUIT DETAILS

In order to make the circuit diagrams easier to read, we have separated the audio and R.F. sections in individual diagrams. Only audio output and power supply leads go from the tuner diagram to the amplifier and power supply section, so that, connecting the two together, both mentally and physically, should present no difficulty.

As with earlier circuits, we have used a single four-position switch to select the broad and narrow selectivity settings of the tuner, and the 78 and L/P functions for the gramophone section. Accordingly, the switch is labelled S_1, with its separate functions designated by letters such as S_{1a}, S_{1b}, and so on. Thus, some sections are found on the tuner diagram, and the remainder on the diagram of the audio section. The EM34 tuning indicator, being an optional feature, has been drawn inside a dotted "box" so that it is an easy matter to see which components are left out if it should be decided not to use it.

Starting with the audio section, we have a pair of KT61 output valves. These are the tubes that were employed in the exceedingly popular "Medium-powered High-quality Amplifier." They give an output triode-connected, of about 6 watts into the primary of the output transformer, if the H.T. is 350 volts, but here we have limited the voltage to 300, so that the output is somewhat less. A power of 4 watts is obtained at the voice-coil winding, and this is any amount for most home uses. As was mentioned earlier, one of the main objects of designing this circuit was to provide a radiogram of very high quality, but rather less costly to build than the nine-valve circuit which appeared in these pages last January. The easiest way to economize in this way without sacrificing quality is to limit the power output. In the present instance, dropping the power output to 4 watts enables us to use one of the excellent low-powered high-quality output transformers that are available at a price within the reach of everybody. Previous high-quality amplifiers we have designed have made use of the 10-watt size of high-fidelity output transformer, even though the output capability of the amplifier may have been less than ten watts. This is a most excellent thing from the engineering point of view, but is not as economical as might be wished. The smallest really good output transformers available—and, indeed, the only ones rated at less than ten watts—are rated to handle five watts of audio at the primary. It is one of these that we have been enabled to use by reducing the power output of the KT61s to within their rating.

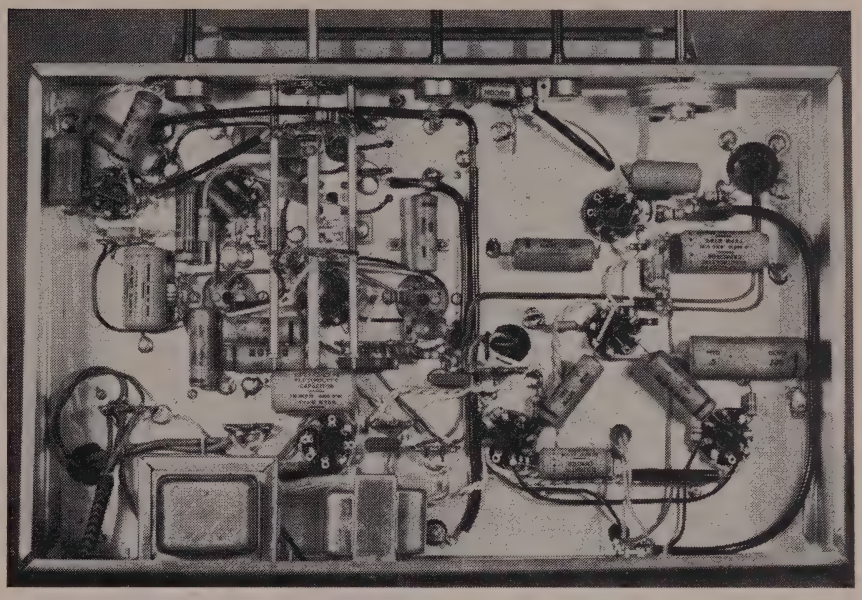


For providing necessary gain in the minimum number of stages, this amplifier uses an ECC32 as a "long-tailed pair" phase inverter. This particular phase inverter circuit deserves to be more used than it is, as it gives excellent balance at all frequencies within the audio range, and beyond, and is exceptionally non-critical as to valve characteristics and circuit constants. The non-critical nature of the circuit can be gauged from the fact that it has been possible to employ direct coupling between the EF37A voltage amplifier and the input grid of the ECC32. This is an excellent scheme, where it can be done, because the usual long-tailed pair circuit has the "spare" grid returned to a source of positive potential—usually the tap on a voltage divider—because of the high resistance in the cathode circuit. In this case, the D.C. potential at the plate of the EF37A has been arranged to be correct for biasing the ECC32, so that no voltage divider is necessary. The 1 Meg. grid leak resistor of the input stage has its lower end bypassed to earth through a 0.5 μfd. condenser, and the other grid is connected to the condenser as well. Thus, the second grid is effectively earthed as far as signal frequencies are concerned, but is at the same D.C. potential as the other grid. Both sections of the tube are therefore correctly biased. It might be thought that such a system would be exceedingly critical, but such is not the case. The reason is to be found in the cathode-follower action of the ECC32 sections, with their high cathode resistor. If the voltage at the EF37A plate rises, so does the cathode voltage of the ECC32, with the result that the difference between the grid and cathode voltages changes hardly at all. In this way, quite large changes in grid potential can occur without upsetting the operating conditions for the valve. It is because of this behaviour that small (or even quite large changes in the leakage resistance of the 16 μfd. bypass condenser in the plate circuit of the EF37A have no appreciable effect on the ECC32 and its operation. On the other hand, if A.C. coupling had been used between the first two valves, it would have been necessary to use a voltage divider to get the positive grid voltage, and when this is done, much lower leakage in the condenser bypassing the tapping point can cause trouble, because this leakage acts as direct shunt on the lower arm of the divider. With the present set-up, there is no need even to worry about using close-tolerance resistors, normal 20% ones being quite satisfactory.

It will be noticed that one of the load resistors of the ECC32 is larger than the other. The one marked 115 k. should be made up from a 100 k. and a 15 k. in series. This difference has the effect

100µµF
100µµF
47K
470K
Audio Out.
3·3K
4·7 MEG
1K
B+
S1b
·001
·1
1 MEG
100K
50µµF
EBF32
·05
330Ω
EM34
S1a
Padder
47K
ECH35
24K
100 µµF
220Ω
33 K
220 K
10µµF
10 K
DRILLINGS: A = 15/32" Dia. B = 1/8" Dia. C = 3/8" Dia. D = 1/2" Dia. E = 3/8" Dia.

of compensating for the fact that with exactly equal load resistances, the circuit gives slightly less output on the side which is not directly excited from the preceding stage.



Feedback is taken, as usual, from the voice-coil winding of the output transformer to the cathode circuit of the first stage. The latter has its normal cathode bias resistor bypassed for audio, and a resistor of 47 ohms is added between the bias resistor and earth. The feedback factor is determined by this and the resistor R, while the frequency characteristic of the feedback is modified at high frequencies by the addition of the condenser C. The values of C and R are determined not only by the amount of feedback required, but also by the speaker impedance. The following table gives suitable values to use for various common speaker impedances. It is assumed, of course, that the transformer ratio is changed to suit the value of the speaker impedance used.

The main amplifier is preceded by the volume control and the variable tone-control network. The latter gives independent control over the high and low-frequency ends of the response, in the manner described in some detail in the article on the nine valve radiogram. The network introduces considerable attenuation, which must be made up for by the provision of a pre-amplifier stage, which is a further EF37A. This is a straight amplifier, and record compensation suitable for a Ronette pick-up is included in the grid circuit. Those who wish to use an Acos pick-up can replace the input circuit with the one given on page 22 of the June, 1956, issue of this journal, where a similar arrangement was used. The circuit is shown as an inset on the main diagram.

On the two radio positions of the selector switch, audio input for the amplifier is taken not to the tone-control network, as might be expected, but to the pre-amplifier valve. Reference to the tuner diagram will show that, as could be predicted, only a very small fraction of the audio output of the tuner is fed to the amplifier. The reason for this is the high sensitivity of the amplifier itself. Feeding all the output of either the tuner or the pick-up to it would result in distortion in the first stage. Doing things in this way has a very beneficial effect on the detector circuit, for it enables the input of the amplifier to be shunted across only a very small fraction of the diode load resistance, so that detector distortion from this cause can be reckoned as non-existent. The 3.3k. lower arm of the voltage divider which makes up the diode load resistor was determined by adjusting the value experimentally until the audio output on radio was approximately equal to that from the average record. There is then no major adjustment of the volume control needed when switching from radio to gram, or vice versa. Should a pick-up be used that has a higher output voltage than the ones mentioned, the builder can reduce the value of the lower portion of the pick-up voltage divider at the input of the pre-amplifier valve so that this tube is not called upon to deliver a greater output voltage.

THE TUNER SECTION

The tuner employs two-point selectivity in order to obtain a wider frequency response for listening to the local stations. However, this feature may easily be omitted at the discretion of the builder, especially if he wants to use a better high-quality tuner for local listening. For example, a synchrodyne could be used, with the built-in tuner relegated to the role of a conventional front end for listening to stations other than the locals. If this is contemplated, the only modification required is to use ordinary I.F. transformers, without tertiary windings, and to give S_1 only three positions, the extra one being unnecessary. The same method of silencing the built-in tuner could be used, however, and those who may be doubtful about making the necessary circuit changes could make things easier by using the four-position switch and merely deleting the third winding from the I.F. transformers. There would then be a blank position on the switch, but the wiring would be identical with the circuit diagram except for the single omission mentioned.

The method used for silencing the tuner on gram is a little unusual, and may require some comment. The switch has been drawn in the narrow selectivity position, which is position 2 from the anti-clockwise end. On positions 3 and 4, which are the gram positions, S_{1a} opens the grid circuit of the EBF32 I.F. amplifier, while S_{1b} opens the plate circuit of the same valve. It will be noted that the screen feed is taken from the common arm of S_{1b}, so that screen voltage is removed when the switch is in either of the gram positions. The ECH35 oscillator-mixer stage functions at all times, but no signal is able to filter through the I.F. stage after it has been treated in this somewhat drastic

manner. There is thus no trouble with radio breakthrough on gram.

ARRANGEMENT OF SELECTIVITY SWITCH

It will be remembered that in the last circuit of this sort that we published, the arrangement of the tertiary windings did not correspond with that used by a well-known manufacturer of I.F. transformers in the pair of variable-selectivity transformers that he produces. This time, the arrangement is identical with that used on the commercial transformers, so that builders may use either the made-up transformers or ones with tertiary windings added by themselves.

Adding tertiary windings to conventional I.F. transformers is not a difficult job, and readers who wish to do it are recommended to read the notes on the subject on page 34 of the February, 1956, issue of this journal, where the process is fully described.

CONSTRUCTION

The construction is illustrated by the photograph on the front cover of this issue, the under-chassis photograph, and the working diagram for the chassis construction. The output valves and the output transformer are at the back of the chassis, with the remainder of the main amplifier symmetrically disposed with respect to these components. Thus the whole of the main amplifier occupies the right-hand side of the chassis, looking from the front. The gang condenser is approximately in the centre of the chassis front, with the ECH35 and EFB32 to its left. The latter is in line with the I.F. transformers, which can be recognized by their size, while the ECH35 is directly in front of the first I.F. transformer. The aerial and oscillator coils are mounted as closely as possible to the left-hand side of the gang condenser, with the former nearer the front of the chassis. The EF37A pre-amplifier valve is to be seen directly to the left of the ECH35, when looking from the front, so that in the photograph on the front cover, it is to the right of this valve. It is also directly in front of the power transformer. The power rectifier is at the left of the transformer in the photograph, and at the left when the chassis is viewed from the front.

In the under-chassis view, the arrangement of the other main parts can be seen. The volume control potentiometer is at the extreme right, with the radio/gram switch next to it. After this come the bass and treble tone controls, respectively, and lastly the tuning control. The sockets for the pre-amplifier and the ECH35 can easily be identified, near the top left-hand corner in the photograph, while the EBF32 socket is partially obscured by the radio/gram switch directly over it. On either side of the switch, midway between back and front, are the I.F. transformer bases. There are only two wafers to the switch. The one near the front of the chassis is concerned with the 78/L.P. switching, while the other one does the narrow/broad switching of the I.F. amplifier. The aerial coil is directly underneath the front wafer of the switch, so that in wiring the circuit it is necessary to make all the connections to the aerial and oscillator coils before the switch is installed and its wiring commenced.

The power supply smoothing choke and the small filament transformer are mounted on the back wall of the chassis, close to the rectifier socket. The 40 plus 40 μf. smoothing condenser is in the front right-hand corner of the chassis, and quite a long way from the rest of the smoothing circuit. This does not matter, however, as the input filter condenser is attached directly to the rectifier socket. Thus there is very little hum voltage on the long leads to the smoothing condensers.

Liberal use has been made of the excellent small co-axial cable that is readily available today in running the necessary shielded leads round the chassis. These can be identified in the photograph by their black covering, which has been stripped off only in short lengths where it was desired to earth the braid to the chassis. One such lead is the one back from the output socket on the back of the chassis, to the input of the main amplifier, carrying the negative feedback connection. Others are from the aerial terminal, also near the back of the chassis, but mounted on top of it, to the aerial coil, and the lead from the pick-up input socket to the switch. The same cable has been used for the shielded grid leads for the two EF37As. One of these can be seen issuing from the wiring associated with the tone-control potentiometers and disappearing through a hole in the chassis to connect to the top-cap of the second EF37A. Another comes from the front switch wafer and goes through a hole near the pre-amplifier socket up to this valve's control grid.

Wiring is done mainly by the point-to-point method helped out by the use of tie-points in the form of insulated solder lugs mounted on the chassis where they are needed. There are a number of these strips, most of which should be readily enough identified in the under-chassis photograph. If they cannot be distinguished in the reproduction, they can certainly be seen in the original print, and those who are anxious to copy the original wiring closely are recommended to acquire one of these from our office in the usual way.

There is one interesting point about the original set, as built, that has not so far been mentioned. It is that an over-sized power transformer was used, because the chassis is to be mounted in an enlarged book-shelf, together with the record player. When a large set is totally enclosed in this way, it is advisable to make it as cool as possible, unless one is going to install a blower for removing the hot air. Thus, although the drain of the whole set was small enough to allow an 80 ma. transformer to be used, in this instance we installed a 100 ma. one. As a result, the transformer runs barely warm, so that the only heat

(Concluded on page 50)

Audio

AMPLIFIERS WITH POSITIVE FEEDBACK

INTRODUCTION

Since it has become standard practice to use negative feedback in order to reduce amplifier distortion to very small proportions, it comes as something of of a shock to find some engineers advocating the use of positive feedback, or regeneration, for exactly the same purpose!

Take up any text-book you like, and it will treat you to a dissertation on the virtues of negative feedback—sometimes covering several chapters in the process. Negative feedback, we are told, reduces the gain of an amplifier, but at the same time it reduces the distortion in the same proportion. We can easily get the gain back by adding more amplification, which these days is cheap and easy to produce, and the advantage of reducing the distortion is so great, that it pays us to go to the greatest possible lengths in order to get more and more feedback on our amplifier. On the other hand, the books say, positive feedback increases the gain, but it also increases the distortion in the same ratio, so that it is quite useless. Negative feedback, we find, improves the regulation of the amplifier, and also the damping on the loudspeaker, but positive feedback again has just the opposite effect. Positive feedback, therefore, is something to be shunned like the plague, and yet now we find the pundits' sage advice flagrantly disregarded. And worse is to come, for the villians who commit this heinous crime claim that by so doing, they actually decrease the distortion in their amplifiers. What is more, they come up with measurements to prove it!

To the ordinary audio enthusiast, who has absorbed the complexities of modern amplifying gear with, in some cases, considerable difficulty, this must certainly seem paradoxical, and we at least could hardly blame him if he threw in his hand at this point, refusing to countenance any more modern developments. That, however, would be a bad thing, as "1066 and All That" so often remarks, and so we take this opportunity of leaping into the breach, to point out (we hope clearly) that all is not so chaotic as might at first sight appear, and that the introduction of positive feedback does appear to be a worth-while development, with good engineering behind it. We hope, then, that those readers who might have given up in disgust will hereupon take heart once more and pigeon-hole the idea for future trial, when a practical circuit appears.

WHAT IS BEHIND IT ALL?

In order to see what positive feedback might accomplish, it is necessary first of all to take a second look at the practical application of negative feedback. In the first place it can be conceded that reducing amplifier distortion by any means whatever is a good thing, and that up to a point, the more negative feedback that can be applied, the better. If this is agreed, it is appropriate to ask a question that may have occurred to many, but which has seldom been answered, namely, "Is there any reason why negative feedback should not be increased indefinitely?" Of course, there is the obvious answer that any attempt to do so results in oscillation, and that very often this sets the practical limit to the amount that can be applied. But there are methods of overcoming the oscillation difficulty, and it is actually possible, by using the appropriate measures, so to stabilize an amplifier that it does become possible to apply larger quantities of negative feedback than are usual in current practice. If the oscillation difficulty is avoided in this way, what is the answer to our question? As the amount of feedback is increased, so does the gain of the amplifier drop, and eventually a point is reached at which we have to employ another valve, for if we do not, the sensitivity of the amplifier will not be adequate for the pick-up, or other device which is to supply the input voltage. It still may be worth-while to do this, because a low-level voltage amplifier stage produces very little distortion, but if, having added the extra stage of amplification, we then proceed to put more negative feedback on the main amplifier we find that the additional stage has to produce more output voltage. In other words, it has to handle a larger signal, so that this stage begins to have a degree of distortion that is not negligible. Finally, we arrive at a point where we have greatly reduced the distortion in the feedback portion of the amplifier, but because the pre-amplifier has been called upon to supply a greater output voltage, its distortion has increased until it is larger than that of the main amplifier; under these conditions, the total distortion is governed not by the main amplifier at all, but by the pre-amplifier stage. There will then be minimum distortion when the feedback amplifier and the pre-amplifier each contribute equal amounts to the total.

It is fairly evident from the above illustration that there must be an optimum amount of feedback for a combination consisting of a main feedback amplifier and a pre-amplifier, not included in the feedback loop. The optimum amount of feedback will depend on the required sensitivity, and on whether the gain control is in front of everything, or between the pre-amplifier and the main amplifier.

It would have been possible, when reduced amplifier gain caused us to add another valve, to include it inside the feedback loop, but this would bring another problem. Or rather, it would bring back one which we thought we had disposed of. The additional phase shifts caused by bringing in a further stage would make it more difficult to keep the amplifier stable, and it would be quite possible for the amount of feedback that could be used with the additional stage inside the loop to be less than could be used without it. This would result in an amplifier with higher distortion than before.

ENTER POSITIVE FEEDBACK

It is almost at this point that our new and revolutionary character comes on the scene, but before we can give him his cue, we will have to indulge in a little elementary algebra. Now the formula which tells us how feedback (either positive or negative) affects the gain of an amplifier is as follows:—

$$\frac{M}{M'} = (1 - \beta M) \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

In this equation, M is the gain without feedback, M′ is the gain after feedback has been applied, and β is known as the feedback factor. It is nothing more than the fraction of the output voltage that is fed back into the input. To take a very common practical case, Fig. 1 shows a skeleton feedback amplifier in which a voltage divider connected across the secondary of the output transformer determines the fraction of output voltage that is fed back to the cathode of the first stage. This will be recognized as a system that is very commonly used in amplifiers at the present time. This fraction, which is the quantity β in Equation 1 above, is easily recognizable as:—

$$\beta = \frac{R_1}{R_1 + R_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

In Eqn. (1), the left-hand side, M/M′, is the ratio of gain without feedback to gain with feedback, and is usually called the Gain Reduction Factor. The formula shows that the amount by which the gain is reduced depends not only on the fraction of output fed back, but on the amplifier gain as well. To illustrate this let us take a practical example again. Suppose we want to use feedback to reduce the gain of an amplifier by half. Then we would have that:—

$$\frac{M}{M'} = 2 = (1 - \beta M) \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

or,

$$-\beta M = 1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

The minus sign simply means that β is negative, for negative feedback. This last equation tells us that if the gain is to be reduced by one half (or a factor of 2, which is the same thing) the numerical value of β multiplied by the gain M must be equal to unity. Thus, if the amplifier has a gain of ten times, one tenth of the output voltage must be fed back. If the amplifier has a gain of 200 times, one two-hundredth must be fed back to achieve the same gain reduction.

We can now see what happens if we leave the feedback factor constant, as we will do if R_1 and R_2 are left unchanged, but increase the amplifier gain. If this is done, the figure $-\beta M$ becomes larger, so that M/M′ also becomes larger. Thus, by increasing the gain that exists inside the feedback loop, the same proportion of output voltage fed back to the input results in more gain reduction. **As we already know, this results in more distortion-reduction as well.** Therefore, if we can do anything to the amplifier that will increase its gain without increasing its distortion, the result will be more feedback and less distortion. Also, since the feedback is already high in a high-quality amplifier, **the gain with feedback, M′, will be very little affected.** Of course, it is not possible to increase the gain inside the feedback loop without causing some slight increase in distortion, but the astute reader will see where the argument is leading us. IF GAIN CAN BE ADDED INSIDE THE FEEDBACK LOOP AND IF THIS CAUSES ONLY A SLIGHT INCREASE IN DISTORTION, THEN THE SAME VALUE OF β WILL GIVE A LARGER GAIN REDUCTION FACTOR, WHICH IN TURN MEANS A LARGER DISTORTION-REDUCTION FACTOR.

This much is not difficult to appreciate, but what is not so obvious is that extra gain reduction wins over the increased distortion, and results in an amplifier with smaller total distortion than before the positive feedback was added. This is in spite of the fact that the positive feedback increased the distortion in part of the circuit. The reason for this seeming anomaly is that the positive feedback, having nothing to do with the output valves, does not increase their distortion at all. And since most of the amplifier's distortion comes from the output valves, it can be seen that the positive feedback does cause a reduction in total distortion.

Once again, a practical example may make the thing clearer, and for our example, we can take a case that is considerably worse than is likely to occur in practice. This is illustrated in Fig. 2. The amplifier is the usual sort of thing, with a moderate sensitivity and a moderate amount of negative feedback. The gain without feedback, M, has a value of 480 times, from the input terminal to the output. The gain-reduction factor is 10, so that the gain with feedback, M′ is 48 times. We then have:—

$$10 = M/M' = 1 - \beta M = 1 - 480\beta$$

From this, we can work out that $\beta = 9/480$. Remembering that β is the fraction of the output voltage fed back to the input, this means that in order to have the characteristics we have assumed, just under a fiftieth of the output must be fed back. We are now going to put some positive feedback round the first stage, and see what happens. We must assume first, that doing so will not render the amplifier unstable, and secondly that we do not alter the resistors in the feedback network. That is, β remains as before.

First of all, it should be mentioned that the total distortion of the amplifier, as it is in Fig. 2, is 0.6%. This means that if the negative feedback were disconnected, the valve distortion would be 6% (gain reduction factor = 10). Now let us suppose further that this distortion is distributed so that 5% comes from the part inside the block, and 1% from the first valve. (We are purposely being a little tough on the first valve, in order to show what will happen when the positive feedback is connected).

When this is done, let us assume that the gain of the first stage is increased by a factor of 7. Its distortion will also be increased to the same extent, so that the total distortion will now be 12%, 7 of which comes from the first stage, with its positive feedback, and 5 from the remainder of the circuit. M, the gain without negative feedback, will now be 480 × 7. β remains unchanged, so that our new formula for the feedback situation, after the negative feedback has been re-attached, is as follows:—

$$M/M' = 1 - \beta M = 1 + 9/480 \times (480 \times 7) = 64$$

We have thus increased the gain reduction factor from 10 times to 64 times, but what of the distortion? Without the negative feedback, but with the positive feedback, the distortion is 12%, so that with both feedbacks, it is 12/64, or 0.19%.

Without the positive feedback, the distortion was 0.6%, so that the total distortion has been reduced by a factor of slightly more than 3, in spite of the fact that the positive feedback increased the distortion in V_1 to 7 times its original value! As was

pointed out above, the figure for the distortion in the first valve was put somewhat on the high side for illustrative purposes. To take the other extreme, and imagine that the distortion in V_1 was zero, it is seen that the positive feedback would not have produced any increase in distortion, so that the reduction in total distortion would have been in exact proportion to the amount of positive feedback applied. In the practical case, the result is somewhere between the extremes. The only remaining question, then is "Can it be done?" so that we will devote the remainder of this article to attempting to answer it.

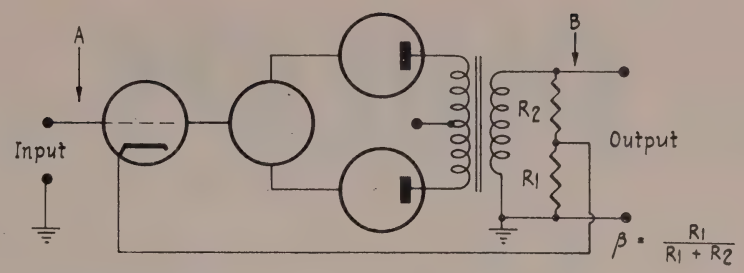


Fig. 1

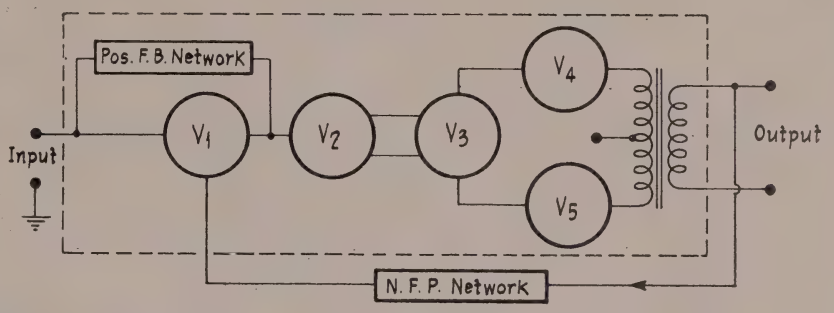


Fig. 2

PRACTICABILITY

In order to assess this aspect of the question of positive feedback, it is necessary to examine the prospect in detail. For example, how would positive feedback be applied in a practical case How much will be possible? Are there any incidental effects to be watched for?

It is not possible to answer all these things as completely as could be wished without having carried out either a full-scale theoretical investigation, or else some practical experiments towards the same end. However, some idea of what would be involved can be gained simply by looking at existing amplifier circuits, and their performance.

The main effects of negative feedback are as follows:—

1. The gain is reduced.
2. The distortion is reduced.
3. The bandwidth for a given drop in response at the ends of the spectrum is increased.
4. If voltage feedback is used (it always is in audio amplifiers) the output impedance of the amplifier is reduced.

The effects of positive feedback are exactly opposite to these, so we do not propose to make a second list, but it should be remembered that all these effects apply only to that portion of the amplifier round which the feedback is applied. For example, if the feedback is applied round a single stage in the amplifier, the effects mentioned occur, but only with respect to the stage round which feedback is connected. Take No. 4, for instance. If feedback is connected round the driver stage, then it is this stage's output impedance that is lowered, not that of the whole amplifier.

This has been stressed, because it is important to remember that there is no question here of applying positive feedback round the whole amplifier, as is done with the negative feedback. Thus, if we increase the gain of one stage of the amplifier with positive feedback, the output impedance of this stage is raised, too, whether we like it or not, but this has no direct effect on the output impedance of the amplifier as a whole, which is still of the same basic form as ever, with a large degree of negative feedback from the output terminal back to the input. Fig. 2 emphasizes that as far as the whole amplifier, and the main feedback loop are concerned, what is inside the "box" representing the amplifier circuit does not matter. What does matter is the total gain inside the box, and this is merely the gain without feedback, i.e., M of the equations. Just how M is obtained is of no interest as far as the main feedback loop, or the amplifier output impedance are concerned.

From the above list, it is apparent that if portion of the amplifier is subject to positive feedback, this portion will have its frequency range reduced, and its output impedance increased as well as having its gain and distortion increased. At first sight, this reduction in the range of frequency response might seem serious in a high-quality amplifier, but it is not, for the effect of the negative feedback round the whole amplifier is to widen the frequency response again. We thus finish up with a frequency response that may be very slightly narrower than that of the amplifier without the positive feedback, but which is still so wide that it extends well above and below the limits of audibility. Such a reduction of frequency response is obviously of no importance whatever.

An important point that has been purposely left out till now is that of phase shift. It is common

(Continued on page 31)

No. 105: A Panoramic Adaptor for Amateur Receivers

INTRODUCTION

We have been asked more than once if we could produce an "Experimenter" giving details of the design and construction of a "simple" panoramic adaptor unit that would not strain the resources of the amateur to construct. This is not really surprising, because almost anyone who operates on an amateur band and who has had even the slightest experience of using a panoramic adaptor decides that he would like one for himself. It is an extraordinarily useful device, which is almost like the addition of a sixth sense, and having to do without one after having become used to it is almost as bad as having to take the tram to work after driving the car there for several years! Perhaps the worst that can be said about the panoramic adaptor is that it does require a not inconsiderable amount of gear and circuitry, and can never really be "simple" in the sense that a two-valve receiver is simple. After all, in order to produce a panoramic display, there are certain functions that must be fulfilled, and to the extent that each separate function must be carried out, it is basically incapable of simplification. However, in the sense that none of the functions we have referred to needs complicated or extensive circuitry in order to fulfil it, it is possible to have an adaptor whose design is straightforward and which does not use too many valves or too complex circuits.

REQUIREMENTS OF THE ADAPTOR

The block diagram, Fig. 1, shows the basic components of any panoramic adaptor. First comes a broad-band input circuit, whose response curve is so shaped that, in conjunction with the response of the receiver at the point of pick-off, the overall response is as nearly flat as possible over a range extending, if possible, 50 kc/sec. on either side of the centre. The output from the main receiver, it will be noticed, is taken off at its intermediate frequency. The adaptor consists chiefly of a superheterodyne receiver, with a highly selective I.F. amplifier. The latter usually has quite a low frequency, mainly because at low radio frequencies it is easier to obtain high selectivity. It is usual to have the I.F. of the adaptor at 100 kc/sec., but this is mainly because 100 kc/sec. I.F. transformers are standard items that can be bought off the shelf, and because 100 kc/sec. transformers can be made selective enough for this purpose. The output of the I.F. channel is detected, amplified, and applied to the Y plate of the cathode-ray tube, giving vertical deflection whenever a signal appears at the detector.

The oscillator of the adaptor is not fixed in frequency, but is made to sweep continuously back and forth round the required centre frequency, say, 50 kc/sec. on either side of this. In principle, the process is no different from manually swinging the tuning control of the oscillator from 50 kc/sec. below the centre frequency, to 50 kc/sec. above it, and back again. Thus, every time the frequency is swept across this band, every signal within it appears momentarily at the detector and causes a vertical deflection to be made on the face of the C.R.T. Now, if the latter had a screen which glowed for several seconds after the spot had passed, it would be quite practical to sweep the frequency of the oscillator by hand, every so many seconds, in which case, as long as one sweep was performed before the trace left by the last had faded out, a continuous picture would be displayed on the cathode-ray tube. But, since the C.R.T. spot fades out almost instantaneously after the beam has moved on, it is necessary to do the sweeping act at a fast enough rate for the persistence of vision to delude the eye into believing that the picture is there continuously.

Accordingly, it is necessary to sweep the oscillator electronically at a fairly large number of times every second. This is done by having a circuit which generates a saw-tooth voltage wave and applying this wave to the control grid of a reactance tube, which varies the oscillator frequency in proportion to the voltage on its control grid. The rate at which the frequency is swept depends on the frequency of the saw-tooth, and this is usually twenty-five times a second or higher. Now, if this saw-tooth is at the same time applied to the X plates of the cathode-ray tube, the horizontal deflection is synchronized with the vertical deflection, and the signals that appear as vertical deflections of the spot will appear spread out along a horizontal line. Thus in the absence of all signals, the picture will be merely a horizontal line, but the moment a signal is present in the range swept through by the oscillator, it will show up as a vertical "blip" on the trace. Moreover, since a given point on the trace corresponds with a given voltage rise from the start of the saw-tooth, and since this given voltage corresponds to a particular oscillator frequency, it is possible to interpret the pattern in terms of signal amplitude, in the vertical direction, plotted against frequency, displayed horizontally.

It can now be appreciated why the adaptor's low frequency I.F. amplifier needs to be highly selective. As the oscillator frequency changes, the output of the detector varies according to the signal strength delivered to it by the I.F. circuit. This amplitude depends on two things—namely, the strength of any signal being received and the frequency of this signal in relation to that to which the I.F. is peaked. For instance, at the moment when the signal has a frequency equal to the I.F. peaking point, the detector amplitude will be maximum. Before and after this point, the amplitude will be less because of the selectivity of the I.F. amplifier, so that as the signal

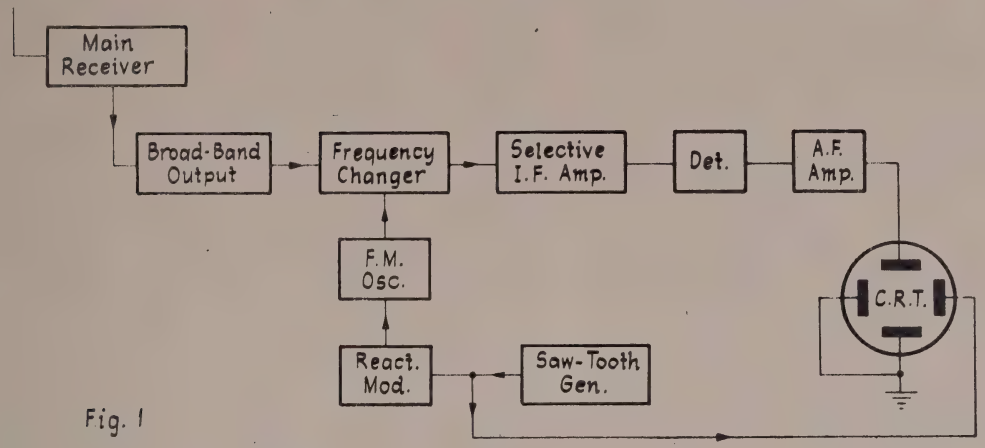


Fig. 1

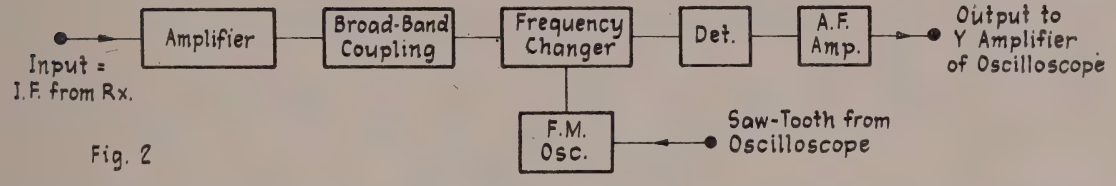


Fig. 2

sweeps through the tuned frequency of the I.F. amplifier, so does the output amplitude correspond to the selectivity curve of this amplifier, and, in point of fact, each signal showing up as a pip on the screen is really a drawing of this selectivity curve.

It must be realized, of course, that we are talking now about the adaptor's I.F. amplifier, and not that of the main receiver. It will be remembered that at the input to the adaptor's frequency changer we have taken steps to make the band of frequencies accepted approximately 100 kc/sec. wide. This is done by taking the signals from the receiver at a point where there is not much selectivity—namely, the plate of the receiver's own frequency changer. Thus, wherever the receiver may be tuned, all signals present within 50 kc/sec. of the frequency to which the receiver is set will be passed on to the panoramic adaptor, but in the main receiver they will all be rejected by its own I.F. amplifier, except, of course, the one to which it is tuned.

A point which arises in connection with the adaptor is, "How can one tell which signal of the many which may show on the screen is the one to which the main receiver is tuned?" This is not difficult to see. Suppose, for instance, that the main receiver's I.F. is 455 kc/sec., and that the adaptor's I.F. is 100 kc/sec. If the oscillator is momentarily tuned to 555 kc/sec., then the signal to which the main receiver is tuned will also be peaked up on the adaptor's I.F. amplifier. Thus, if 555 kc/sec. is made the exact centre of the range swept by the oscillator, this frequency will correspond with a main receiver frequency of 455 kc/sec. and therefore with the signal being received. Being the centre frequency of the oscillator sweep, 555 kc/sec. will also correspond with the centre of the trace on the cathode-ray tube. Thus, when the adaptor is properly tuned up, the centre of its trace always corresponds with the frequency to which the main receiver is tuned.

It will have been noticed that throughout this discussion no mention has been made of actual signal frequencies. The adaptor comes off the main receiver at its intermediate frequency, so that the actual signal frequencies that correspond at any time to the frequency calibration of the C.R.T. trace depend upon the signal circuits of the main receiver. Thus, whatever the signal frequency, the calibration of the panadaptor's trace is still true, because it is referred at all times to the I.F. of the main receiver. This scheme has the overwhelming advantage that the band displayed on the 'scope has the same width, irrespective of signal frequency. This would not be the case if the pick-off were made at any point preceding the main set's frequency changer.

EQUIPMENT TO BE BUILT

In the first instance, it can be assumed that one possesses a main receiver with which the adaptor is to work, so that, to build an adaptor, one can either start from scratch and build everything else, or one can dodge a certain amount by using an existing oscilloscope. This will almost certainly contain amplifiers for X and Y deflection, and a saw-tooth generator, not to mention the high-voltage power supply for operating the cathode-ray tube. Many amateurs do have cathode-ray tubes working, either as complete oscilloscopes or as modulation monitors, so that there should be little necessity for us to describe the cathode-ray-tube circuitry at all. However, should we receive sufficient inquiries for suitable circuits for the 'scope portion of the equipment, we shall be pleased to consider publishing them. It should be possible to cull suitable circuits from the literature, though, because the requirements of these portions of the

arrangements are in no way tied down by the adaptor. About the only restriction is that the time-base should go down to about 25 c/sec., and that it should be possible to bring out the saw-tooth voltage to the adaptor, while having it displayed on the screen in the usual way. As long as this can be done, the circuits we are about to describe here will enable anyone with reasonable constructional skill to make a very satisfactory adaptor for himself.

With these things in mind, the block diagram of what we are to describe reduces to Fig. 2. If this is compared with Fig. 1, some differences will be noticed that are not accounted for by what has already been said. The most obvious one is that the block labelled "Reactance Modulator" is missing. This is because we are to use a special oscillator circuit which is able to act as its own reactance tube at the same time, thus doing away with one valve, at the expense of slightly complicating the oscillator circuit itself. The second difference is that an amplifier stage is shown ahead of the broad-band input circuit. This stage acts as an amplifier at and about 455 kc/sec., and tends to offset some of the signal lost by broad-banding the input circuit. This becomes a broad-band coupling circuit between the amplifier and the frequency changer.

The next difference is that the block labelled "Selective I.F. Amplifier" has been omitted. This indicates that this portion of the circuit does not contain an amplifier at all. It could do, but as long as the circuit provides adequate selectivity, amplification at the I.F. of 100 kc/sec. is not strictly needed. Instead, we have retained a stage of amplification following the detector. Two 100 kc/sec. I.F. transformers are used to get the required degree of selectivity, but instead of coupling them through a valve, they are cascaded simply by connecting the secondary of the first to the primary of the second through a very small coupling condenser. In this way the selectivity of two transformers is retained with negligible loss of signal amplitude, and without adding amplification that is not really needed.

Because of the modifications to the usual valve line-up, the adaptor contains only four valves and not very much circuitry. Indeed, the original has been built on a chassis measuring only 8 in. x 5 in. x 2 in.

The valves used are: 1 EF50, 1 ECH81, and 1 EF80 and 1 ECC82. Also required are two 100 kc/sec. I.F. transformers (Inductance Specialists Type 102) and one 455 kc/sec. I.F. transformer (Inductance Specialists Type 142 or 122). Next month we will present the full circuit and give constructional details and photographs of the unit.

(To be continued.)

N.Z.A.R.T. NOTES

That the year 1955 had been a milestone in the history of the N.Z.A.R.T. was apparent from reports presented at the Annual Conference held in Auckland during Queen's Birthday weekend. Alas, Auckland, like Dunedin, involves much travelling for many members, and thus attendance was a little down on that of previous years.

Summarizing the year's activities, the President, Mr. H. F. Arnold, ZL3HA, referred to the transfer of the journal "Break-In" from Dunedin to Christchurch, and to the proposals concerning the proposed change of name of this magazine. This matter had been the subject of a competition, which unfortunately failed to produce a name acceptable to the judges. During the year, new branches have been formed at Patea and Te Puke, with the former also establishing a section of the Amateur Radio Emergency Corps. In addition, the Fiji Radio Club has sought affiliation with the N.Z.A.R.T., which would enable it to secure representation with I.A.R.U.

During 1955, the advertising revenue from "Break-In" reached an all time high, which has been reflected in the general composition of the journal. Congratulations on this were extended to the retiring advertising manager.

As usual, the QSL Bureau has shown a small profit, but it is noted that the number of inward cards through the Bureau exceeds the outward postings. This can mean one of two things: either New Zealand amateurs use the direct postal method for the majority of outward cards, or they are a little tardy in the art of QSL-ing.

Nelson, Waimarino, and Invercargill sections have been active on emergency searches throughout the year, many other sections taking part in large scale trials. In addition to the section formed at Patea, an additional one has been formed at Hawera, and the Upper Hutt branch has been revived. The incorporation of these sections has done much to augment the general coverage of the Amateur Radio Emergency Corps, and so offer a better service to the country in the event of emergencies.

Roy Needham, ZL1KG, of Pukekohe, has been engaged "in the design and construction of a prototype battery-powered transmitter-receiver, which eventually will replace the type 208s in use at present." The acquisition of a number of battery-powered units in all sections will ease the position considerably, as the ZC1 is not an ideal unit for portage in difficult terrain.

The Council of the Association has been in constant touch with the Post and Telegraph Department on the matter of television frequencies, general amateur frequencies and other matters administered by the Department. Representations to the Wiremen's Registration Board are still progressing, and it is hoped that the N.Z.A.R.T. will soon make a satisfactory arrangement with the former body.

Mention must be made of the thrill given many of the 80-metre boys when FU8AC came up on that band some time ago. All that can be said on the credit side is that many were in the hunt! The operating ethics of the majority, however, left much to be desired. If this state of affairs continues, obviously some of the Pacific Island Stations will think twice before using this band, and if members want DX on these bands, then they must treat the stations which do appear with a little consideration.

Positive Feedback

(Continued from page 27)

knowledge that at the extreme ends of the frequency range of an amplifier that uses negative feedback, the phase shifts that occur through the amplifier circuit result in the feedback turning round and becoming positive. Furthermore, if, at frequencies where this has happened, the gain from the input to the output, and back through the feedback circuit to the input again is more than unity, the amplifier will oscillate. Now if the positive feedback is applied to the amplifier, the effects of the phase shifts, which take place whether or not there is any feedback, will be opposite to those caused with negative feedback. In other words, the positive feedback could easily turn round and become negative at the extreme ends of the frequency range. It is quite possible that this effect might be very useful in practice. For if the positive feedback can be induced to become negative at those very frequencies at which the negative feedback has become positive, it is probable that the two feedbacks would tend to cancel. Thus, at the danger frequencies, the positive feedback would reduce the tendency towards instability. There is only one snag to all this, namely that we have pre-supposed that the positive feedback is effective over only a portion of the amplifier circuit, whereas the negative feedback is over the whole amplifier. This being so, it would not be possible to obtain complete cancellation of the undesirable effects of the negative feedback, but there is little doubt that the effect of the positive kind would be beneficial, if the circuit values are properly proportioned.

As to how positive feedback can be applied in practice, it is only necessary to look at two stages in an amplifier. Suppose, for example, that the first stage is a triode voltage amplifier, and that this is followed by a phase inverter of the type which has equal load resistors in plate and cathode circuits of a triode. If feedback is taken from the cathode of the phase inverter, back to the cathode of the first stage, the latter being unbypassed, the result would be positive feedback. This would not prevent the bottom end of the cathode resistor from being connected to the potential divider across the output transformer secondary for completing the negative feedback circuit, just as in Fig. 1. Nor would the desired amount of positive feedback be difficult to calculate. The feedback formula, Eqn. 1, is quite general, so that if we want a particular value for M/M′, say, $\frac{1}{6}$, which would make M′, the gain of the stage with feedback six times M, the gain without feedback, we then have

$$M/M' = 1/6 = (1 - \beta M), \text{ or } 6 - 6\beta M = 1,$$
$$\text{or } \beta = 5/6M$$

Thus, if M is known, we can find the fraction β. If M is 14 times, $\beta = 5/84$, and this is the fraction of the signal voltage at the plate of the phase inverter that must be fed back to the cathode of the first stage. This is approximately one seventeenth, which is quite a large fraction—large enough to cause a little practical difficulty. For example, if a resistor is connected (with a blocking condenser, of course) from the phase inverter cathode to the cathode of the first stage, so that this resistor, together with the first cathode resistor forms a voltage divider, the feedback resistor would have to be only sixteen times the value

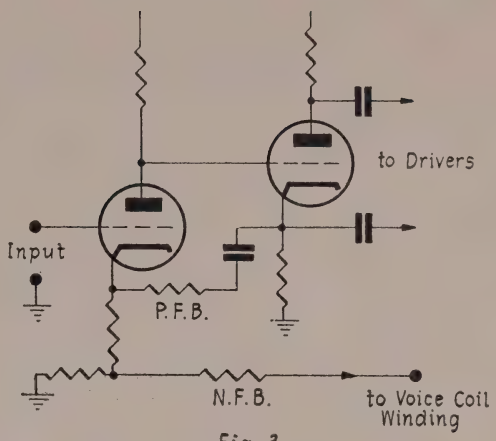


Fig. 3

of the cathode resistor—somewhere between 15 and 30k. Thus, the blocking condenser would have to be quite large in value. Fortunately, however, the feedback circuit would produce little A.C. shunting on the cathode of the phase inverter, because of the low output impedance there, but it would be essential to check that such shunting as does exist does not upset the phase inverter balance. If it does, the answer is to alter the value of the cathode load resistor in the phase inverter until balance is restored. In Fig. 3 we have drawn a circuit showing how positive feedback could be applied in this way, together with the normal negative feedback connection. No values have been inserted for the feedback resistors, because their values would depend on the other circuit constants. Still, this might be enough to enable the experimentally minded to try the scheme on an existing amplifier.

For the Amateur

FEEDING ROTATING ARRAYS

We have often been asked the best way of feeding R.F. power to rotatable aerial arrays, and, more especially, how to solve the knotty problem when continuous rotation is wanted. Of course, when rotation is restricted, there is no problem at all, because the array can then be fed by conventional means, with arrangements made so that the feeder can twist through 180 degrees each way, from the position where the aerial is exactly opposite the stop. All that this entails is to see that there is a sufficient length of feeder left without attachment to the mast or tower, so that a twist of 180 deg. will not strain it. There is little difficulty in arranging this, as a rule, and the principle can be used both with co-axial and with twin-lead feeders. If the tower is reasonably high, it can even be used with strained feeders, provided that the spacing is close—say, one to two inches—and that the portion that is allowed to twist is provided with spacing insulators at intervals of three to four feet.

However, the purpose of this article is to give some tips on the more difficult job—namely, that of feeding efficiently an array whose rotation is not restricted in any way.

CONTINUOUSLY ROTATABLE ARRAYS

The difficulty here is not so much mechanical as electrical, for it is essential with this sort of aerial that there should be no mechanical coupling between the rotating and non-rotating portions of feeder, and that there be efficient R.F. coupling between them, irrespective of the position of the rotating part. By saying NO mechanical coupling, it will be noticed that we have immediately ruled out sliding contacts. These can be quite satisfactory, but only if they are given constant maintenance to ensure that they are not corroded by the weather. If we add to this the fact that they are likely to be in a fairly inaccessible position, thus discouraging regular inspection and cleaning, it is seen that sliding contacts are not likely to be quite as satisfactory in practice as they can be in theory.

This leaves as almost the sole solution, the use of a pair of coils, mounted co-axially with the rotating mast or drive shaft, and coupled in such a way that the coupling between them does not vary as rotation takes place. The questions to be answered thus resolve themselves into the following:—

(1) Does the coupling system need tuning?

(2) If so, how is the proper L/C ratio determined?

(3) When this has been fixed, how can the coil or coils be made to have the required inductance?

Let us look at these questions in turn, as far as possible from first principles. We can assume for a start that we have a feeder of some sort issuing from the aerial tuner. This can be either co-axial or open-wire, and in a case like this should certainly be of the "flat" or untuned variety. This means that the far end of it must be connected to a load that looks to the feeder like a pure resistance, equal in value to its own characteristic impedance. This is just

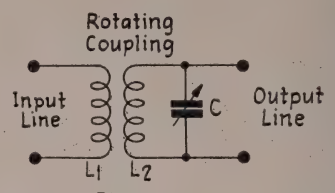


Fig. 1

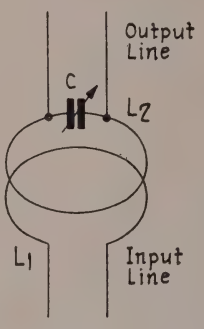


Fig. 2

what we do when we connect such a feeder directly to an aerial. If the aerial does not happen to match the feeder impedance directly, a matching device is used between it and the feeder—a transformer, no less, which steps up or down, according to requirements, the impedance of the aerial until the impedance of its input terminals does match that of the feeder. Sometimes, in addition, the matching transformer is called upon to connect a balanced load, such as a dipole, to an unbalanced feeder, or a balanced feeder to an unbalanced aerial, like a quarter-wave vertical.

Now the problem we have set ourselves in relation to the rotating array is no different in principle from the conventional aerial-to-feeder matching trick. The chief difference is only the unfamiliar look of what has to be done, and this comes about only because we have to effect a match between two lengths of feeder rather than between an aerial and a feeder. To illustrate this, we have drawn Fig. 1, which shows one arrangement that will often be required. We have assumed a balanced open-wire feeder from the coupling unit to the aerial array, because the latter is almost always one which requires a balanced feed.

The next point to consider is the impedances of the feeders, both to and from the coupling unit. In the (a) arrangement, that of the co-axial line, will almost always be either 50 or 70 ohms, while if (b) is used, one can please oneself within quite wide limits as to the line impedance used. As usual, however, this will usually be inside the range 200 to 600 ohms.

On the aerial side of the transformer, it is possible to have to match almost any impedance, right at the

aerial. The aerial impedance can range from a few ohms, for a high-gain parasitic array, to a few thousand ohms for certain types of collinear array. This would appear to make it an almost impossible job to specify a coupling arrangement that will suit all possible types of aerial, but in this instance we will dodge part of the difficulty by assuming that there is some matching device which will bring the aerial impedance up or down, as the case may be, to a figure of about 600 ohms. Now this is quite fair, because, even when a rotating coupling is not to be used, the aerial must have a matching arrangement. As we will see in a minute, the figure of 600 ohms has been chosen purposely, as being one which will suit our coupling transformer better than most.

CHOICE OF L/C RATIO

In one important way the circuits of Fig. 1 are deceptively simple, because they do not indicate at all the factors that govern the design of the transformer. At this point it should be said that it is NOT satisfactory to make the secondary side of the transformer just any old circuit that tunes to the operating frequency. Indeed, if the L/C ratio is not properly chosen, it is quite likely that the circuit will either be found impossible to tune, and horribly inefficient, or else that, though tuned, it is impossible to transfer any useful amount of power through it. In this respect the transformer may be regarded as very similar to the plate tank of a final amplifier, except that, since its load impedance is much lower than is found in an amplifier tank circuit, the L/C ratio will be quite different. Fortunately, it is not at all difficult to do the necessary calculations, especially with the aid of the various charts that are available in places like the A.R.R.L. handbook and Beatty's Radio Data Charts. As for the primary winding, which we have shown as untuned, there is little difficulty, because all that is necessary there is to use a small link coil, and to adjust the loading in the usual way by varying the coupling between it and the tuned secondary.

As with most tank coils, the tuned circuit of the coupler should have a reasonably high Q-value, when loaded up by the output feeder. If it has too low a Q, it will be difficult to get tight enough coupling between primary and secondary, and it will not be possible to load the transmitter fully. If the Q is too high, other difficulties will appear. For instance, it will be found impossible to obtain proper coupling over a sufficient range of frequencies. In practice, this will mean that frequency changes will necessitate re-tuning of the coupler. Since the latter is likely to be high up on the tower or pole, this behaviour would be quite unpractical. A good compromise value of Q is between 5 and 10. This Q will be great enough to give added discrimination against the radiation of harmonics, just as does any tuned circuit that may be inserted between the transmitter and the aerial. For any bands as narrow as the amateur ones, this value of Q is unlikely to be so high as to require re-tuning as operation is shifted from one end of the band to the other.

The desired value of Q must be obtained, not when the circuit is unloaded, but when the output feeder is connected. This is equivalent to connecting a resistor of 600 ohms across the tuned circuit, so that we must call theory to our aid if we are to find the L/C ratio which will allow this Q to be obtained under the conditions specified. Fortunately, there is a simple formula which connects the load resistance, the Q, the frequency, and the inductance, in the following way:—

$$R_1 = 2\pi . f . L . Q \qquad \ldots . (1)$$

In this formula, R_1 is the load resistance, π is the usual 3.14, f is the frequency in cycles per second, and L is the inductance in henries. In this form, it is not particularly easy to use, but only because we will want the figure for inductance to come out in microhenries, and because we would prefer to express the frequency in megacycles per second. However, it is the most convenient form to use for illustration purposes.

In this equation, we know R_1, because we have decided that this will be 600 ohms. We also know Q, because we have decided that 5 would be a good figure to aim at. We know f, the operating frequency, so that the only unknown quantity is L, the inductance of the coil. If, therefore, we substitute in the formula the values of the known quantities, and work out the resulting arithmetic, we will find the value of L. This can most easily be done by rearranging the formula as follows:—

$$L = \frac{R_1}{2\pi . f . Q} \qquad \ldots . (2)$$

because in this form it can easily be seen that we know all the quantities on the right-hand side of the equation.

Of course, we also want to know the value of capacity to use, to tune L to the operating frequency f, but, once we know L, we also know that there is only one value of C that will do this, so that finding L has really fixed the design of the tuned circuit. Sometimes it is more convenient to use a formula which gives the value of C directly, and instead of finding the coil's inductance and then using a chart to find its dimensions, the approximate value of C can be set up using a variable condenser, after which the inductance can be juggled experimentally until it tunes to the right frequency with the known capacity. Accordingly, it is possible to use this formula instead:

$$C = \frac{Q}{2\pi . f . R_1} \qquad \ldots . (3)$$

In this equation, C is in farads. In order to make results easier to work out, equations (2) and (3) can be rewritten so that L is in microhenries, C is in micro-microfarads, f is in megacycles per second, and R_1 is in ohms. We then have:

$$L = \frac{R_1}{2\pi . f . Q} \text{ microhenries} \qquad \ldots . 2(a)$$

$$C = \frac{10^6 . Q}{2\pi . f . R_1} \ \mu\mu f. \qquad \ldots . 3(a)$$

To give some idea of the kind of L/C ratio that will be arrived at in a practical case, we will work out an example, using equation 3a. Suppose that Q is to be 5, the output feeder impedance is to be 600 ohms, and the frequency is 52 mc/sec. Then, substituting in equation 3a, we have:

$$C = \frac{10^6 . 5}{6.28 \times 52 \times 600} = \frac{500}{19.6} = 25 \mu\mu f.$$

It can be seen that the circuit is quite a high-C one, or, in other words, has a low L/C ratio. Looking at the formula, we can see that the higher the Q we require, the higher the C in the circuit. Similarly, the lower the impedance of the feeders leading to the aerial, the higher will the C become.

PRACTICAL CONSIDERATIONS

Although the above formulae are intensely practical in that, without them, we would just be guessing in the dark, they can lead to answers that are quite impossible to put into practice. For example, suppose the output feeder is a low-impedance one, and suppose also that we want a high Q. Both these requirements call for a very low L/C ratio, and, while under ordinary conditions it might be possible to realize this in practice, it may not be possible to do so under the conditions which obtain in the present case. For example, as Fig. 2 shows, the coupling coils must surround the mast, which should preferably be of some low-loss insulating material. Now, in achieving a very small inductance, the smallest number of turns we can use is one. Now there is no harm in using a single-turn coil, and in practice one will often be used, with its diameter arranged so that it has the required inductance. But if the conditions call for too small an inductance, the single turn may be too small to put round the pole, in which case the theoretical answer, while correct enough, is quite impracticable. Ordinarily, the coil should be as large in diameter as possible, so that it will not come too close to the pole.

If the calculation indicates that an impossibly small inductance is required, there is no help for it but to alter the conditions, either by accepting a lower value of Q, or by arranging for an outgoing feeder from the coupler, of higher impedance than the one originally allowed for. If either or both of these expedients are used, it will be found possible to design a practicable system.

BANDWIDTH

As mentioned earlier, the coupling system must have sufficient bandwidth not to require re-tuning while it is in use. Fortunately, the low Q values that we are forced to use automatically make the coupler a wide-band affair. In the case worked out already, the Q is 5, and the centre frequency is 52 mc/sec. The bandwidth is therefore $52/5 = 10.4$ mc/sec., which means that the frequency can be taken out 5.2 mc/sec on either side of the centre frequency before the power transferred would be half of that at the tuned frequency. With a Q of 10, the bandwidth would be halved, but would still be great enough to cover the whole six-metre band quite efficiently.

In the second and final instalment of this article, we will consider the question of making the coupling circuit so that it conforms with the calculated specification.

(To be continued.)

News About New Publications

GERMANIUM DIODES

By S. D. BOON.

(Published by Philips' Technical Library. Distributed in New Zealand by Philips Electrical Industries of New Zealand Ltd., G.P.O. Box 2097, Wellington. Price 9/6d.)

By the introduction of the semi-conductors, a new element made its entry into electro-technology. The nature and structure of these semi-conductors are entirely different from those of electronic tubes, whose sphere of application they are successfully invading. As an initial example of this new development, this book deals with the germanium diode, whose properties, simplicity, small size and reliability are shown to the full.

Soon after the first crystal rectifiers had become known, interest in this new circuit element increased all over the world, and today, only a few decades after the new diodes made their appearance in electronic equipment, this interest has assumed such proportions that the germanium diode can now easily hold its own among the vacuum diodes and is even driving them out of positions that seemed unassailable. Since every technician is now having to deal more and more with germanium diodes, it is of interest to deal in a simple manner with the structure and nature of crystal diodes, and to discuss in detail their electrical properties inasfar as these are of fundamental importance to their proper use. Since the crystal diodes differ from vacuum diodes in their electrical functions, the circuits in which they are used can usually not be designed by means of the parameters to which we have grown accustomed. The permissible currents and voltages are sometimes defined in a different way. The ambient temperature, which is hardly of importance with high-vacuum diodes, is a factor to be reckoned with in the case of germanium diodes. The subject-matter of this book has been so dealt with as to fully meet practical requirements; exhaustive theoretical studies have been avoided, but at the same time an attempt has been made to afford the reader an insight into what he needs to form an independent judgement of the diodes, and thus to enable him to analyse such diode problems as he is likely to meet and to use them in circuits himself. For this latter purpose, the book contains a number of examples of practical applications, which may serve the reader as a guide.

WIRELESS AND ELECTRICAL TRADER YEAR BOOK 1956

(Published by the Trader Publishing Co. Ltd., Dorset House, Stamford Street, London, S.E.1. Price 12/6d. Postage 1s.)

Wireless and Electrical Trader Year Book, which was first published in 1925, has become the most important reference book to the radio and electrical industries. It is the standard guide for all connected with sales or services and of great assistance to overseas buyers wanting to contact British sources of supply.

The principal contents include a Directory of Principal Trade Organizations, Legal and General Information, Radio Receiver I.F. Values, Valve Base Connections Diagrams, Trade Addresses, Wholesalers' Directory, Proprietary Names Directory, Classified Buyers' Guide and much information relating to TV Receivers and Servicing in the United Kingdom.

For ease of reference, the Year Book is divided into sections printed on distinctively coloured paper, and each section is separated by a stout card, with thumb index, giving details of contents.

One of the principal aims of the Year Book is to assist traders to keep abreast of the constant changes in the names, addresses, telephone numbers and products of the firms engaged in the radio and electrical industries. The directory sections incorporating these revisions, together with the carefully selected technical information and other practical data, made the **Trader Year Book** an invaluable time-saving reference book for every retailer and business man in the industry.

RECORD TALK

by JOHN GRAY

All opera lovers have heard of Cetra, the Italian firm which specializes exclusively in operatic recordings and whose products have remained obstinately unprocurable in British countries, that is, up to now. An Australian distributor has just begun handling the discs, and the New Zealand agency has been secured by Mr. Norman Wright, Box 3160, C.P.O., Auckland. He has begun with a release of extended play 45s of excerpts from well known operas, and complete sets will follow (there is, for example, a most attractive-looking set of Verdi's "Masked Ball" with the exquisite tenor Tagliavini). I imagine that few opera fans will waste time before putting themselves on Mr. Wright's mailing list.

Philips have shown an upsurge of activity in the past few weeks, both popular and classical releases testifying to their vast repertoire. The weird tale of the "Shifting, Whispering Sands" has been "Narrated" at us from almost every label of late, and it comes as a distinct relief to encounter Geraldo's version (P26213) which dispenses with the talk and lets us hear a tasteful rendering by chorus and orchestra. The reverse is a bright waltz, "Lights of Vienna". Another record from piano stylist Henri Leca takes us back a few years to "Blue Tango" and "Meet Mr. Callaghan" (P17233). Among new vocalists is a Greek singer, María Pavlou, who makes her debut with "I Remember Mama" and "My Lonely Lover" on P26187, and in the up-to-the-minute category Philips have a coupling of "Dungaree Doll" and "Rock and Roll Waltz" by the Bee Bee Sisters on P17520. They have also begun an issue of extended play 45s, tastefully and glossily packaged. Winifred Atwell's party numbers will have a ready sale in their new guise (BBE12010) and there are excerpts from Benny Goodman and Duke Ellington LPs, while in the serious category are some Bach from Schweitzer and Scarlatti sonata from Robert Casadesus.

Sir Thomas Beecham surprises us with Elgar's Enigma Variations (backed by the Cockaigne Overture and the Serenade for strings); surprises us, that is, because he has not, of late, been particularly associated with Elgar's music. This is a magnificent record (ABL3053) and the cover is of extraordinary interest, being adorned with photographs of all Elgar's friends who form subjects of the different variations, an intelligent idea which must have caused Philips time, research, and expense. Sir Thomas is represented also by remakes of Mozart's Linz and Haffner symphonies (ABL3067) and a blazing performance of five Berlioz overtures, including the very rarely heard "Waverley" (ABL3083). There are many issues of standard orchestral works, notably a gorgeous new "Scheherazade" by the Philadelphia Orchestra under Ormandy (NBL5013), but in some ways the most interesting items on the list are two issues of music from a much earlier period. One is of a "Festival Mass" composed by an Italian, one Orazio Benevoli, for the consecration of Salzburg Cathedral, which took place in 1628. It is subtitled "Mass in 53 Parts", that is, there are 53 separate staves in the full score, a massive volume which, we are told, measured something like three feet by two feet. This vast tome was personally trundled across the Alps from Italy (no Brenner Pass in those days!) in time for the consecration ceremony. The effect of the double choir, umpteen soloists and orchestra, as captured by this new recording made recently in that same Salzburg Cathedral, is both awe-inspiring and quaint, though despite the huge forces involved the music is still very much of its period. Possibly as a means of reducing distortion, the piece has been issued on two ten-inch discs (ABR4015-6) instead of one twelve-inch, as it was in America. The other outstanding release is an organ record by E. Power Biggs (ABL 3066). It features music by old North European composers such as Sweelinck, Pachelbel and Buxtehude, played on various old organs which Biggs encountered during a tour of Germany, Holland and Scandinavia. The idea is a splendid one and has been well realized in this absorbing issue (there is one old organ which actually had to be pumped by hand) and a second disc is to follow. The Philips list contains a great deal more, ranging from two well made Mozart piano concertos, K491 and K537, played by Robert Casadesus and conducted by Georg Szell (ABL3606) to a complete recording of Gershwin's masterpiece, "Porgy and Bess" with a cast headed by Camilla Williams and Lawrence Winters, and conducted by Lehman Engel (NBL 5016-8). Many people have gained a false impression of this work through hearing the catchy "numbers" which have been released from time to time in the last few years. In its way, "Porgy" is a real opera, of astonishing strength and power.

Tanza's Stardusters are well up to their own high standards in their newest issues, "A Woman in Love" and "I Love Paris" on Z278, "The Shifting, Whispering Sands" and "At My Front Door" on Z266. Mercury's Crew Cuts are on form with "Slam Bam" and "Are You Havin' Any Fun" (M4157) while Rusty Draper tells us about those Sands yet again, and at length, on M4154. Meanwhile Festival are well into their stride, revelling in the treasures they have acquired from American Decca and its subsidiaries. A regular flow of popular 78s in their bright yellow labels bears witness to the continued survival of this speed for current hit parade issues; even Bill Haley's "Rock Around the Clock", formerly procurable only on 45, has now made its reappearance on 78 (FS841). Of the newer tunes there are Russ Morgan's "Dogface Soldier" (FS 803), Teresa Brewer as inexhaustible as ever in "Shoot it Again" and "You're Telling Our Secrets" (CS832), and Don Cornell in "Young Abe Lincoln" and "Dream World" (CS833). The LPs feature the popular fiddler, Florian Zabach, in standard romantic numbers (CFR10-795), a brand new Carmen Cavallaro (CFR10-854), the veteran Paul Whiteman conducting a medley of Fred Astaire dance routines (CFR10-858), and a very intriguing collection of the song hits of 1916, almost thirty of them, as done by Roy Ross and his Orchestra, with a few vocals by Tony Russo, on CFR10-793. The year 1916 was a productive one, and among the titles which have remained consistent favourites since that distant time we note "Down Among the Sheltering Palms", "Nola", and "Roses of Picardy". On the other hand, who now remembers "They're Wearing 'Em Higher in Hawaii", or even what exactly it was they were wearing? The American Decca catalogue has similar discs covering song hits of each year from 1917 until 1944; their issue would be both attractive and valuable.

Rock and Roll should almost have run its course by now, or at least so one feels after listening to Johnny Cooper's "See You Later, Alligator" which HMV have thoughtfully made available in two speeds (HR70 or 7MMO70). Nothing will stop this number, in which, as an overseas contemporary observes, the Rock and Roll process is carried "to the point of idiocy", so let us hope it will come as a grand finale to the series, because this music is, fundamentally, both monotonous and tuneless. It is a relief to turn to a decent tune like "Love and Marriage" which the evergreen Dinah Shore sings on HR10178, together with a number called "Compare", or to the caressing tones of Nat King Cole, with his "Someone You Love" and "Forgive My Heart" on Capitol 3234.

HMV are first with a number honouring what is for many people the only really important event of the year for New Zealand. Called the "All Black's Football Song", it is featured by the Woolston Brass Band and vocal chorus on Columbia DNZ101. Its backing is "Amparita Roca". Also from the home front are three Parlophone singles (NZP5005-7) by the Aotearoa Maori Choir, back from a successful Australian concert tour. Of these, NZP5007, with "Haere Mai" and "Now is the Hour", will probably be the favourite.

Amid the lighter LPs we find Columbia coming up with an original and welcome idea, "An Evening With Robert Burns" (33CX1317). The bard is honoured in both songs and poems, arranged to make a programme which should be in demand by Burns Clubs and kindred organizations wherever Scotsmen are gathered. The speakers include Ian Gilmour and Meta Forrest, the singers Frederick Westcott, Margaret Fraser and Constance Mullay, the accompaniments are by the Saltire Music Group directed by Hans Oppenheim, who is apparently a Scot by inclination if not by name. For those on the lookout for something unusual by way of lighter orchestral fare there is "The Lady and the Fool", a ballet arranged by Charles MacKerras from the mine of good tunes found in Verdi's many unfamiliar operas. The arranger seems to have done as good a job as he did with Sullivan's music in "Pineapple Poll", and he conducts the Philharmonia Orchestra in this welcome piece of Verdiana (CLP1059).

Locally produced LPs include the outrageous "Spike Jones Murders Carmen" (HMV MDLP 6007), which is good for a laugh first or second time round; thereafter it will be most

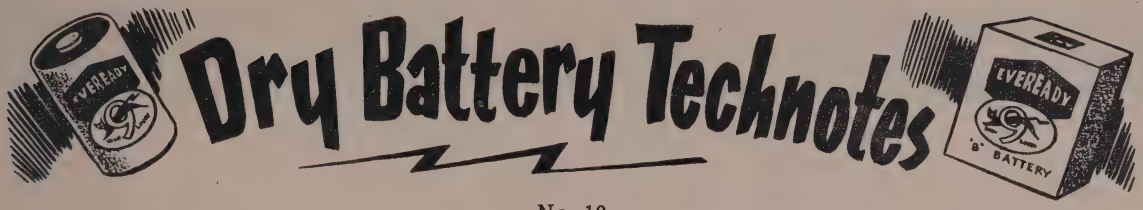
useful for playing to people who have never previously heard it. On the reverse are the brilliant parodies on William Tell, Dance of the Hours, etc. Johnny Cooper's numbers have been gathered on to MDLP 6004, and the whole of the original 1930 repertoire of the Rotorua Maori Choir has now been assembled in handy form on three Columbias, 33MS 6001, 6003, and 6004. This is a splendid idea and sales should justify the enterprise. There are many good things in the imported discs, an Irish collection by Ruby Murray (33S1079), the third Jimmy Shand LP (Parlophone PMD 1029) and a collection of the religious ballads of George Beverly Shea (MDLP 6003) should all find their public with little difficulty. There is also a group of the earlier Capitol discs put out to satisfy continuing demand. Joe Fingers Carr's "Bar Room Piano", for instance (H280) could well enliven many a convivial gathering.

The flood of Mozart is still in full flow and I fear that readers may soon be heartily tired of this composer's name. But those who feel that he reached perhaps the highest peak in his operas and piano concertos have much to interest them in the latest list put out by the HMV group. Another "Figaro" (ALP1312-5, with the cast of Glyndebourne's 1955 performance, on seven sides and very nearly complete) and another "Don Giovanni" (Vienna Opera under Krips, Decca LXT 5103-6) have arrived to complicate the issue still further. By now the "Big Five" operas are handsomely represented, and if I attempt a choice in each case, it is with the usual reservations as to personal taste. However here it is, for what it is worth: "Il Seraglio", Fricsay on Deutsches-Grammophon; "Figaro", Kleiber on Decca; "Don Giovanni", Moralt on Philips; "Cosi Fan Tutte", Karajan on Columbia; "Magic Flute", if you do not object to an oldish recording, Beecham on HMV. That I recommend one opera from each of the five leading makes of record is, I assure you, quite coincidental. These are my honest preferences, at this moment! Two of the best of the piano concertos have arrived on HMV, in superb performances by Solomon (ALP1316), the A major K488, which is possibly the public's favourite of them all, and the dramatic C minor K491 which has some claims to being the greatest, as music. Its only rival in seriousness of mood is the equally dramatic D minor K466, done once again, this time on a ten-inch HMV (BLP1066) by Edwin Fischer, who follows his usual practice of directing the Philharmonia Orchestra from the keyboard, an undertaking which was common enough in Mozart's time but seems rather unnecessary now. I prefer the more urgent (if rather fast) performance by Serkin and Eugene Ormandy on a Philips ten-inch. Before we leave Mozart, for this month at least, there is a further splendid symphonic coupling on CLP1063, where Harry Blech and his London Mozart Players offer the "Linz" together with the brilliant No. 34 in C major K338, to which has been added a C major minuet written by Mozart at a later date. In its original form, and as generally recorded, the symphony is minus a minuet. Finally there is a truly lovely performance of the E flat quintet for piano and wind K452, played by Walter Gieseking with the Philharmonia Wind Quartet on 33CX 1322, and coupled with a quintet in the same key which Beethoven wrote for the same combination—piano, oboe, clarinet, horn, and bassoon.

Returning to the realm of the piano concerto we find the first release in this part of the world of the Saint Saens No. 4 in C minor, an unduly neglected piece which is handsomely done by Brailowsky with the Boston Symphony on ALP1321. There is solid worth in the music of this devilishly clever composer who often sounds like many of his illustrious predecessors and contemporaries, and I cannot help wishing that this C minor had been issued together with one of the others, instead of the familiar Chopin in F minor that has been chosen as a mate for it. Saint Saens also comes into his own with a well made disc of highlights from his faded but enduring "Samson and Delilah" (ALP1308). Many people are more disposed to single disc condensations than to expensive complete versions of such works, and all the big solos of Delilah are featured here by the voluptuous voice of Rise Stevens, with Jan Peerce as a stirring Samson and Robert Merrill filling in as the High Priest of Dagon. The conductor is Leopold Stokowski, who makes a brilliant show of the well known ballet music, and the disc is rounded off with the catastrophic final scene, in which Samson brings down the house (literally!) to a cacophony of yells and shrieks from the Robert Shaw Chorale. Only the more cantankerous will fail to enjoy this old fashioned thriller.

Thrills of a different order come in three of the grandest of grand operas, "Aida" (33CX 1318-20) "La Forza del Destino" (LXT 5131-4) and "Turandot" (LXT 5128-30). The last named is new to LP and features the soprano Inge Borkh, who can certainly cope with Turandot's terrifying utterances. The other soloists, headed by del Monaco and Tebaldi, are those who have featured in Decca's long list of Italian operas and the recording is fine. "La Forza del Destino" scores over the recent Columbia version in being absolutely uncut and correspondingly dearer, to the extent of an extra disc. The Columbia is perhaps the more exciting performance and I should not advise those owning it to make a change, unless they definitely prefer Tebaldi to Callas or del Monaco to Richard Tucker. The minor characters are better on Decca, but there is really little to it. Decca includes an important scene wherein Fra Melitone (Fernando Corena) has an amusing time distributing soup to a crowd of ill-mannered beggars, and Columbia omits this episode which, of course, really has nothing to do with the gloomy drama forming the main plot of this lugubrious but endlesly fascinating opera. In the case of "Aida" the choice is more difficult. On Decca, Tebaldi and Stignani are magnificent, the men rather less so, the recording more spacious. On Columbia everybody is magnificent, the performance catches fire from the third act onwards, and the recording is rather cramped. The cast is headed by Callas, Barbieri, Tucker and Gobbi, with Serafin in charge of the La Scala forces. On balance I should go for Columbia, but I should be a spoilsport were I to refrain from mentioning that HMV have a version up their sleeves. This will feature Milanov, Barberi (again) Bjorling and Leonard Warren, and was made recently at the Rome Opera.

Back to the lighter sphere before we end; there is just time to hail the new Capitol LP of the sound track of "Carousel" (W694) the enchanting Rodgers and Hammerstein musical play which features one of the best scores ever put out for a musical show. HMV have made a handsome job of this disc, which highlights all that is best in this sphere of music.



No. 10.

In presenting this series of technical notes on the use of dry batteries in various kinds of equipment, it has been our aim to assist you to understand some of the less-known features of dry batteries, and, by so doing, ensure that maximum service life is obtained in the almost innumerable applications for dry batteries which exist today. One quite erroneous impression some people seem to have obtained is that the techniques of battery manufacture have remained static for many years. Most of you know that this is not the case, as proved by the fact that nearly all the large battery factories throughout the world can now show considerable increases in battery service capacity over the past 10 years in particular. For instance, today the New Zealand plant currently produces a cell giving considerably better service than any overseas battery imported by New Zealand prior to the war years. New ways are always being developed of improving the dry cell, which, after all, cannot change its external appearance very much! In this respect, batteries resemble car engines, which have undergone considerable improvements in recent years—especially with regard to performance—without looking very different to the layman. Similarly, new applications for batteries are themselves causing manufacturers to develop new types specially for them. A case in point is the "A" battery for hearing-aids. This is identical in size and shape to the well-known pen-cell used for miniature torches, but there is a considerable difference in the interior mix which goes to make up the finished battery. The fact that a hearing-aid imposes a continuous drain on the battery rather than the intermittent drain associated with flashlight usage calls for a special mix formula, particularly suited to this usage. Although the two batteries could be used in either a hearing-aid or flashlight, neither will give maximum performance when used outside the application for which it is designed.

We quote this simple example in order to lend point to the appeal we make to all makers of electronic equipment requiring dry batteries to consult the National Carbon Pty. Ltd. early in the design stages of any new equipment. As specialists in this field, we are, of course, the best qualified to advise on battery problems. Our special laboratory facilities enable us to render material assistance to manufacturers by advising them on the best kind of battery for each job. In New Zealand, as in other countries, a new dry-battery-operated device has often turned out a success or otherwise just because the maker has or has not obtained sound technical advice about its battery requirements before it was too late to make the necessary design changes.

As an example of our ability to help in this way, we may mention the part the local National Carbon factory is currently playing in dealing with problems related to dry batteries for the forthcoming New Zealand Antarctic Expedition. There, the question (or rather, one of them) is, "How many batteries constitute a two-year supply?" This could be answered satisfactorily only by carrying out comprehensive life tests under sub-zero temperature conditions, because it is known that, under such conditions, dry batteries give only a fraction of the life to be expected at normal temperatures. Tests under these conditions have been carried out in the National Carbon factory in Wellington, and the results have not only given us the answer for the purposes of the expedition, but are there for all time, to enable us to answer questions relating to any low-temperature applications of our batteries.

Then, again, following overseas trends, many makers of electronic equipment are turning their thoughts towards transistors and their applications. It would surely be a coincidence if all present-day types and sizes of dry battery should be found better suited to transistor work than any that might be specially designed for use with them. Naturally, this is another field in which we have been keeping in close touch, and we are well able to give advice on transistor applications, along with the more conventional ones.

Finally, may we stress once more the importance, if good battery service is to be obtained, of ensuring that theequipment which is to use them is "on the line." It may seem strange, but we can quote numerous examples of complaints about batteries in which we have been able to demonstrate that the equipment itself was at fault, or that the wrong type of battery was being used.

Although this is the last of the present series of Technotes, we expect, from time to time, to be presenting new and interesting data on batteries and their use. It is thus "au revoir," and not "good-bye," that we say now to readers of these notes, with the reminder that, when it comes to dry batteries, National Carbon is here to help you. A letter, telegram, or personal call is all we need if at any time you are in doubt on the battery angle.

MISSING AND STOLEN RADIOS

Auckland:

Autocrat 8-valve, 12 volt, universal manual tuned car radio, serial No. 29452, new condition, hammer grey colour.

Autocrat cowl type radio aerial.

Hamilton:

Philco Clock radio, pale oak cabinet, 15 in. x 6 in. with blue facings, clock dial left, radio dial right.

Philips battery/electric portable radio, serial Nos. 85723-15273. Walnut or brown plastic cabinet 12 in. x 9 in.

Philco 6-valve mantel model radio, cream plastic cabinet, 14 in. x 10 in., with open back.

Whakatane:

Pacemaker 5-valve radio, serial No. 52515, cream plastic cabinet with back missing.

(Continued on page 52)

ELECTRICAL AND TRADE SECTION

BELL AND ALARM SYSTEMS—PART II

Reproduced from the *Practical Electricians' Pocketbook for 1955.*

BURGLAR ALARMS

The requirement of a burglar alarm system is that it must give audible warning should an unauthorized entry be made through any door, window, or skylight. There are two methods of doing this—one is to provide concealed switch contacts at each point, which will be closed if, say, a window is opened. The overruling objection to this system is that the burglar only needs to locate and cut the wire to the switch and so put the alarm out of action. Further, this system does not give protection against the breakage of glass in a window or the removal of a panel in a door.

For these reasons, a closed circuit system is used in which a current continually circulates, and it is when this circuit is interrupted by the opening of alarm contacts or by the cutting of a wire that the alarm is given. The closed circuit is actually a circuit of wire conveyed around the inside of any protected area. While the circuit remains intact, the current energizes a relay, holding apart contacts of the alarm circuit. Should the closed circuit be broken, the relay is no longer enefgized, and the contacts come together and operate the alarm devices.

The closed circuit is made to pass all possible points of entry. Across doors which are in a general way used as passageways through a house or other premises, contacts are fitted and protection is given to door panelling. When it is not convenient to pass a wire round an area, floor traps and the like may be employed. Objects of particular value may be given individual protection by arranging contacts in such a way that if the articles are removed the closed circuit is broken.

When an emergency alarm button is required, this is done by connecting a normally closed push-button in the closed circuit, so that when depressed, the closed circuit is broken.

There are several different closed-circuit burglar alarm systems available.

In domestic installations micro-gap or special spring-loaded contacts should be fitted at the base of all doors and may also be fitted to windows, although window protection is not always considered necessary because an intruder entering a window almost invariably opens the room door to prepare a passage through the premises for a speedy getaway in the event of being disturbed. In commercial and industrial premises, however, it is often essential that the windows be protected as there may be sufficient value in the one room to confine the intruder's operations to that room alone.

Where there is a number of removable shutters across a window or area, a light alloy rod may be spanned right across these shutters, clipping into spring clips at either side of the window area, so that, should the shutters be moved or disturbed whilst the alarm is set, the rod becomes displaced and gives instantaneous warning. This is achieved by wiring the spring clips to form part of the closed circuit.

When planning protection for industrial premises, the premises must be viewed from outside and every possible point of entry protected, i.e., skylights, windows, doors, chutes and hatches, and the following methods are recommended:

The whole of all skylight and window areas must be protected. Lengths of light conduit should be affixed to the frames, spaced not more than 6 in. apart over the entire area. The wiring of the closed circuit is then made to pass through each tube in turn, the wires to be pinned at the top and bottom in such a manner that if the tubes are displaced to force an entry, the wire is broken.

Contacts should be fitted to the doors and opening lights. In the event of the door being light wood panelled, conduit should be fixed across the panels to frustrate any attempt to saw out the panels.

"Hold-up" alarm buttons, where desirable, as in banks, offices, etc., having a public counter, can be fitted as part of the system. This requires normally-closed push-buttons to be included in the closed circuit. It will be seen from the above that it is purely a question of ingenuity, bearing in mind that any adaption should be sufficiently firm to avoid false alarms, yet positive in action if disturbed.

When protection is required while the premises are occupied, after deciding which points need protection, it will be found that there are times when the whole of such protection would be inconvenient. Therefore, in some makes of burglar alarm systems, provision has been made for sections of the protective circuit to be inoperative as circumstances may demand.

DIVISION OF PROTECTIVE CIRCUIT

This is done by positioning a selector switch operated by a master key. Position 1 gives emergency protection only; in business premises, emergency protection is effected by a normally-closed button, or buttons, at the cashier's desk or suitable point for the watchmen. Wiring to skylights and fixed windows may be brought into this circuit. In domestic premises, a similar button is concealed near-to-hand by the front or back door, in the hall, or at the bedside. In Position 2, the selector switch provides the protection referred to in the above paragraph, plus all doors on the downstairs circuit in domestic premises; in business premises, it adds special stock rooms or bonded out-of-bounds areas. At Position 3, full protection is provided when the premises are unoccupied.

The external bell should be of ironclad pattern and weather-protected, and may have a 6–12 in. gong. It should be fixed in an inaccessible position. If the wiring is not in steel conduit, it may be run in twin T.R.S. It is advisable that no wire should be shown on the outside of the building although the master unit protects wiring as follows: if any attempt is made to interfere with the external bell, i.e., hammer disturbed, both the internal and the external bells will give immediate warning.

INDUSTRIAL AND COMMERCIAL INSTALLATIONS

In industrial premises, wiring between all protected points should be conveyed through conduit, and cables of the flexible type are recommended. This, together with the conduit covering affords adequate mechanical protection. The wires running through the conduit over the protected area are, of course, of a much lighter gauge than those used for interconnecting points. They should be no stronger than 7 strands of .0076 or 36 gauge.

In all types of burglar alarm, provision should be made for testing; for rendering the circuit inoperative when necessary for maintenance. Means are required to enable the last door to be closed by the last person leaving the building, and for the alarm to be silenced when an authorized person enters when the premises re-open. How this is done is information which, obviously, must be confined to as few persons as possible. Suffice to say that, besides actual breakage of the circuit, any attempt to disturb the external bell, to tamper with the lid of the control box, or to operate the control incorrectly will immediately set the internal and external alarms in operation.

FIRE ALARMS

The first requirement of a fire alarm system is that it should give immediate warning of the start of an outbreak of fire.

The simplest form of fire alarm system is a bell or an audible alarm which can be rung by the first person to detect the fire. This is adequate only for small establishments. For larger premises there must be a large number of bells which can be rung simultaneously, and there must be a central indicator to show the origin of the fire call.

Where premises are left unattended, means must be provided for giving the alarm without human aid. Usually a thermostatic detector is employed. Various types are available.

A fire alarm system also may be adapted to stop motors or operate fire doors when an alarm is given.

As in the case of burglar alarms, either open circuit or closed circuit systems can be used. The latter is gaining in popularity because, by reason of the constantly flowing current the system is always under test. Fire alarm systems are usually operated from accumulators, kept charged through a trickle charger. The system is then independent of mains failure, or of faults which may have been set up by, or may have caused, the fire.

In addition to flag indicators, luminous types in which a lamp glows are used. These luminous indicators are sometimes mounted on a plan of the premises, and give instantaneous indication of the location of an alarm.

Fire alarm installations may be connected directly to the fire brigade station so that the alarm is given there automatically. At the station an alarm receiving panel is provided. This consists of a number of drop flat indicators to which the various installations are connected by means of private wires hired from the Postmaster-General.

On receipt of a fire call, the indicator connected to the affected building is operated, and simultaneously the alarm is set ringing. The lines connecting the protected buildings with the fire station are under automatic test (circulating current) at all times.

PLASTIC UPHOLSTERY FOR "NEW LOOK" CARS

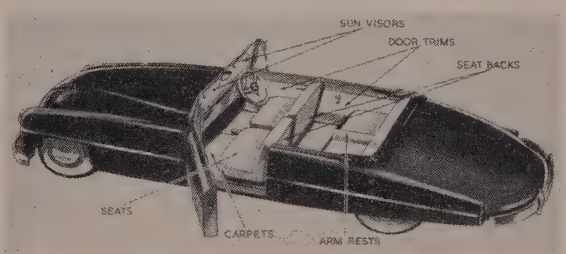
Come what may in startling new shapes and engines, one feature of tomorrow's car can be predicted with certainty. Its seat upholstery, carpets, sun visors, arm rests and door trims will be made in attractive, hard-wearing plastics, instead of the materials in general use today.

This major development in the car industry follows the introduction of new materials, which have been evolved specially with plastic welding in mind, and new Redifon welding techniques. Together, they will enable manufacturers to mass produce vehicle upholstery for the first time.

The P.V.C. material used for the new-type car interiors will have a wearing life three times longer than that of leather. It can be made in a variety of shapes, sizes, colours and patterns—cheaply, quickly and easily. Trimming a seat for example, takes only a few seconds. An extremely simple operation, it merely entails laying loose P.V.C. on top of the padding material and closing the electrodes of the welding press. In less than half-a-minute the upholstery is ready, complete with quilting.

As it is, the work can be performed by unskilled personnel after a very brief period of tuition. But, looking ahead, the motor manufacturer will find he can readily adopt the advanced Redifon equipment to his automation schemes. Already two internationally known car builders plan to use Redifon equipment in ancillary automation lines.

Only one operator will be necessary on each line, and his sole job will be to feed the material to rollers that will carry it to the ralio frequency press. After welding, it will be taken out of the heating zone automatically and fed down to the main assembly line.



One feature of the car of tomorrow which can be predicted with certainty is that its seat backs, upholstery, sun visors, arm-rests, and trims will be of plastic.

ANNUAL CONFERENCE—N.Z. RADIO & ELECTRICAL TRADERS' FEDERATION

Preceding the Annual Conference of the New Zealand Radio and Electrical Traders' Federation held at Wanganui on 21st May, 1956, delegates and their wives spent a happy two days as guests of the Wanganui Branch, enjoying scenic drives through the district, film evenings and time for social discussion over a friendly glass. Highlight of the "extras" was the Conference Dinner which brought proceedings to a happy conclusion on Monday evening.

The presentation of the President's (Mr. A. K. Griffith) Annual Report, published elsewhere in this issue, opened a lively discussion, the matter of Power Board Trading receiving first consideration.

Power Board Trading

Delegates were informed that figures of the trading by all Power Boards and Local Bodies throughout New Zealand for a period from 1944 to 1955 had been supplied to the Minister of Finance prior to his receiving a deputation led by representatives from the Federation, supported by a member each from the Associated Chambers of Commerce, the New Zealand Retailers' Association, and the New Zealand Electrical Federation. The matter was approached from the Income Tax angle and received a sympathetic hearing from the Minister, who was attended by two senior members of the Inland Revenue Department. The Minister advised that this matter would be referred to Cabinet.

During the discussion which followed, Mr. B. C. Barwick, of Wanganui, the Federation's Representative on the Deputation to the Minister, stressed that though the Federation had achieved its object, it should continue to study the position closely, and members should report to their local associations any trading activities by Power Boards in their area. Mr. D. Walker, also of Wanganui, questioned the source of money with which the Power Boards were enabled to enter into such extensive trading, and suggested that this came from Local Body Loans raised for purposes of reticulation and power and not intended for the erection of expensive show-rooms. He contended, that, from the accountancy angle, it might prove simpler if the whole of the profits of Power Boards, including the supply of power, was taxed, and that the State Hydro Department was exempted from tax instead of the Power Boards, as at present. Other delegates questioned the rights of Power Boards to sell goods on Hire Purchase at low or no interest rates when they were using monies raised by loans for other purposes. Finally, discussion on this subject concluded with congratulations to the Committee on the manner in which it had pursued the matter up to the present juncture.

Radio Interference

Reporting on the activities of the Radio Interference Standing Committee on which he is the Federation's Representative, Mr. A. K. Griffith announced that equipment to measure the standard of interference has now arrived in New Zealand, and that, in the meantime, provisional standards of interference based on the United Kingdom standards had been adopted. New regulations were being drafted, and these were to be considered by the next meeting of the committee early in July. A difficuty about the enforcement of the regulations appeared to be lack of penalty for infringement. However, it was hoped that the new regulations would overcome this. In Mr. Griffiths's experience a substantial quantity of imported equipment requiring filtering in the country of origin, frequently arrived in this country either without filters or with filters sold as an extra. He expressed the hope that in the next twelve months, some more definite action would have taken place to reduce the interference suffered by the unfortunate listener.

Appointment of a Liaison Officer

After some discussion, it was decided that a Liaison Officer should be appointed to keep contact with member Associations and individual traders, thus furthering the aims of the Federation and that Mr. P. Rothschild's offer to undertake such duties in an honorary capacity for a limited term be accepted. The question of a suitable honorarium for such an appointment was left in the hands of the incoming committee.

Bulletins

When considering the Wellington remit on this subject, disappointment was expressed that the Federation did not make as much use of its official journal, "Radio and Electrical Review" as is desirable. The Editor of that journal expressed his willingness to co-operate with the Federation in this matter in every possible way. It was suggested that each Association at regular intervals should forward to the Federation matters of interest to be incorporated in a bulletin, which one of its members undertook to produce if desired. Finally, it was resolved that the incoming executive should investigate the publishing of a bulletin for the benefit of the whole of the trade, whether members or otherwise, and that the offer of the Federation member to produce the bulletin be accepted with thanks.

Restriction of Trade Prices to Legitimate Retailers

During the discussion of the Wellington remit that the Federation be requested to approach wholesalers asking that they should ensure that trade prices should not be extended to other than actual members of the trade entitled to be members of the Association, it was explained that the purpose of this was to prevent members of the public securing articles at wholesale prices either because they had a radio dealer's licence or for some other reason. Mr. D. Walker suggested that this was really a matter for each local Association to take up with the wholesalers serving their district, by exerting pressure on them to refrain from such sales, otherwise the retailers would refuse to handle their goods. Finally, it was left to the incoming committee to prepare recommendations on methods of enforcement of this remit.

Radio Advertising

It was resolved that the Federation should give special consideration to Air Advertising over the four main ZB commercial stations, to further the aims and objects of the Federation. The costs for same are to be referred to the district Associations for final acceptance.

It was decided that the Taranaki Association should appoint a representative to attend Federation Committee meetings when this matter is under action.

Radio Trade-In Handbooks

Conference was advised that it was hoped that the 1956 Radio Trade-In Handbook would be available early in August. It was suggested that, in order to assist Federation funds, copies of the Trade-In Handbook should be sold to members at 5s. per copy and to non-members at 10s. per copy.

Travelling Expenses

Though the Otago remit re a delegates' fare pool was not favoured, it was agreed that the difficulty of expense might be overcome if some of the Executive Meetings could be held in Canterbury. Finally, Conference recommended for the consideration of the incoming Committee that at least two of the more important executive meetings should be held in Christchurch each year.

Subscriptions

It was resolved that the affiliation fee for the ensuing year should remain as at present, namely 25s. per member of each affiliated Association.

Three-Pin Plugs and Connectors:

According to a circular from the State Hydro Electric Department, all plugs and connectors had to be approved by that Department before they could be sold. It was pointed out to Conference that there is no plug at present on the market which complies with the SHED regulations, and traders therefore are in difficulty concerning the types of plugs and connectors they

can safely sell. Finally, it was resolved that the Secretary should be instructed to write to SHED inquiring which type of plugs and cord connectors complied with the SHED regulations.

Sales Tax

In view of the fact that Sales Tax has now been removed from furniture and musical instruments, but not from radios, Conference resolved to request the Minister of Customs to give urgent consideration to the removal of sales tax from radio receivers.

Apprenticeship

The small number of radio apprentices entering the industry was viewed with concern, and it was suggested that the leaflets printed some two years ago should be circulated amongst secondary schools again in order to encourage boys to enter the radio trade. Upon learning that a qualified electrician did not have to sit the radio technician's examination, as he automatically qualified to handle a radio, and that for this reason boys entering the trade preferred to qualify as an electrician with a wider scope than as a radio technician, Conference decided that the Federation should write to the Electrician's Registration Board, expressing dissatisfaction with the present arrangements which permit an electrician to act as a licensed radio technician.

Second-hand Dealers' Licenses

Members were advised that if they deal in second-hand radios, it is necessary to possess not only a radio dealer's licence, but also a second-hand dealer's licence.

Intermediate Frequency

It was resolved that the Radio Manufacturers' Association be approached requesting that they stamp the I.F. on each chassis.

Credit Control

It was suggested that, in order to provide more time for discussion, future conferences should be opened on the day preceding the official day of the conference, and that routine matters such as election of officers, confirmation of minutes, etc., should take place on that opening day. It was also suggested that an Executive Meeting should take place before and after the conference. Though the matter was discussed at some length, no unanimous decision was reached.

Credit Conference

During the afternoon of Conference, Mr. Hargreaves of the D.I.C., gave an address on "Credit Control—Its Cause and Cures". For political reasons, he said, a number of cures, while in themselves most effective, could not be put into practice as no government would survive. It was generally considered that the present method of restricting credit was the best method of curing the inflation which caused such a drain on the country's overseas funds.

Election of Officers

The election of officers for the ensuing year resulted as follows:—

President: Mr. A. K. Griffith, Nelson (re-elected).

Vice-President: Mr. B. C. Barwick, Wanganui.

Executive: North Island Minor Associations, Mr. J. Fairclough, Napier; South Island Minor Associations, Mr. N. J. Hallet, Wellington.

Auditor: Mr. Gordon Berry (re-appointed).

Representative on Radio Interference Committee: Mr. A. K. Griffith (re-appointed).

Secretary: Mr. C. I. W. Archibald, Wellington (re-appointed).

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NOTES FROM OVERSEAS

THORN TO ENTER C. R. TUBE MARKET

From newspaper reports we gather that the Thorn Electrical Industries plan to enter the cathode-ray tube market, and "to cut the cost of television tubes to the public". The tubes, it was stated, should be on the market within 18 months, and a new company would be formed jointly with Sylvania Electric Products Inc., of America.

As is well known, Thorn and Sylvania have worked closely together for some considerable time, and are associated jointly in Sylvania-Thorn Colour Television Laboratories Ltd., the company which was formed to develop colour picture TV tubes at an economic cost in Britain. The Sylvania-Thorn colour laboratory is at present under construction at Enfield.

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PHILCO SUB-MINIATURE TRANSISTOR

The Philco Corporation announces the introduction of a sub-miniature transistor, believed to be the smallest yet developed.

The tiny electronic device is so small more than 20 can be placed on a sixpenny piece. The device operates in the audio frequency range and performs the functions of larger size transistors.

Philco engineers report the new transistor, named the M-1, can be employed in electronic systems where miniaturization is an important factor, including guided missiles, computers, hearing aids, portable radios and many other amplifying equipments. The M-1 alloy-junction transistor is now going into production at Philco's transistor plant.

Using the new "mighty midgets", Philco's Government and Industrial Division has assembled a miniaturized amplifier about the size of an ordinary pencil eraser. The amplifier, constructed for demonstration purposes only, has a 70-decibel gain, or a power gain of 10 million, and utilizes a new type of direct-coupled circuitry developed principally for electronic computers by Philco.

In spite of its tiny size, the new sub-miniature transistor is covered by a metal can which is hermetically sealed by welding to protect the device from moisture and other contaminants.

Philco engineers stated that the M-1 transistor possesses unusual strength by virtue of its tiny size. Excess mass—a weakening factor—has been eliminated. The device can withstand an acceleration rate of 20,000 "Gs" (20,000 times the force of gravity) without change in characteristics.

It also has the transistor's inherent qualities of long life, ruggedness, light weight, and low power consumption. The M-1 will operate on as little as one ten-thousandth of a watt.

Like most junction transistors, the basic operating portion of the M-1 consists of a wafer of germanium. In this case, however, the wafer is about the size of a pinhead. Leads are soldered to a dot of indium on each face of the wafer. The M-1 is a PNP transistor. That is, it contains three layers; a positive ("P"), negative ("N"), and positive ("P"). The centre region is the base and the other regions are the emitter and collector.

The Electronic Tube and Transistor Division also manufactures Philco's high-frequency "Surface-barrier" Transistor (SBT) which is now being mass-produced for use in computers, communications equipment and military applications, as well as power transistors, diodes and other semi-conductors. The "Surface-barrier" Transistor operates in the very high frequency range of 40 to 80 megacycles.

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.

EICO RADIO TEST INSTRUMENT KITSETS

John Gilbert and Company Ltd., of Tasman Buildings, Anzac Avenue, Auckland, are proud to introduce EICO Radio Test Instrument Kitsets to New Zealand. Though new to New Zealand, this is far from a new line in the U.S.A., as the Electronic Instrument Corp. Inc., commenced production of Instrument Kitsets in 1945, and now have over 500,000 instruments in use. There are over 1200 EICO Distributors in the U.S.A. covering "coast to coast".

EICO's mass purchasing and world-wide distribution, together with finest components and advanced electronic design, produce values never before possible. In fact, it amounts to Laboratory Precision at Lowest Cost.

The range of instruments include V.T.V.M.s with 4½ in. and 7½ in. meters (with accessory probes to measure peak-to-peak voltages, R.F. voltage to 250 mc/s. and high voltage to 30 kv.), Tube tester, Fly-back transformer and Yoke tester, Battery tester, 5 in. Push-pull oscilloscope, 5 in. D.C. wide-band oscilloscope and 7 in. oscilloscope, Accessory Oscilloscope Probes, Scope voltage Calibrator, Electronic Switch, V.O.M.s 3 in. and 4½ in. meters and 1,000 or 20,000 ohms per volt Capacitance and Resistance Substitution Boxes, 3 types R.F. Signal Generators, Sine and Square Wave Audio Generator, R.C. Bridge and R.C.L. Comparator, De Luxe Multi-signal Tracer, Decade Resistance and Capacitance Boxes, TV/FM Sweep Generator, a Geiger Counter, and Battery Eliminator with two ranges 0–8v. at 20 amp. max. and 0–16v. at 12 amp. max. overload protected. These EICO Test Instruments are available in kitset form, and also as fully wired instruments (factory tested, wired and calibrated). EICO instruments are suitable for 230 volt 50 cps. mains.

Each EICO kitset comes complete with "Beginner-Tested" manuals which make assembly and operation step by step quick and crystal clear. "You build them in one evening and they last a lifetime".

EICO instruments are most reasonably priced. When buying instruments why not see the EICO equivalent (kit or wired) first. Get the most for your money.

There are EICO distributors throughout New Zealand.

For further particulars and name and address of your nearest EICO distributor, write to John Gilbert and Co. Ltd., Tasman Buildings, Anzac Avenue, Auckland, C.1, the sole New Zealand agents for Electronc Instrument Corp. Inc., U.S.A.

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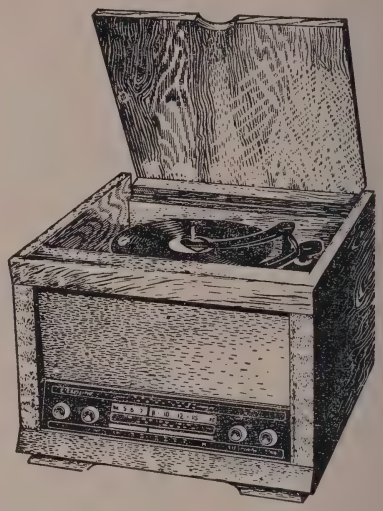
CLIPPER TABLEGRAM

The new Clipper table radiogram (model 5G6) brings the advantages of the console model to all yearners after radiograms afflicted either with lack of space or lack of funds. The Clipper 5G6 is ideally suited to the flat dweller with very limited space; to the younger folk who want to play the records



they like or hear **their** favourite programmes; and to all those reluctant to lay out the cash necessary for a console model.

The Clipper Tablegram offers world-wide listening: on the Broadcast band and the Shortwave band between 16 and 49 metres. Its power, quality of reception and tone are completely adequate, and in looks the Clipper Tablegram is most attractive and suitable for any home.

The cabinet is available in blonde or dark oak, and is extremely compact. The position of dial and controls enables the radio to be operated without lifting the lid of the record-player compartment. Dimensions are: 12⅞ in. high x 17⅝ in. wide x 17¾ in.

The record player incorporated is the Garrard R.C. 110 automatic changer which plays 7 in., 10 in., and 12 in. records at all speeds. The turn-over crystal pick-up unit has readily replaceable stylii. The Clipper Tablegram model 5G6, is a 5-valve, dual wave model with 6 in. loudspeaker and retails at £44 10s.

All Clipper models are manufactured in New Zealand by Akrad Radio Corporation Ltd., Waihi, and distributed solely by G. A. Wooller and Co. Ltd., Head Office, Box 2167, Auckland, and branches at 43 Lower Taranaki Street, Wellington, and 16-18 Victoria Street, Christchurch.

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TWO NEW ULTIMATES OF DISTINCTION

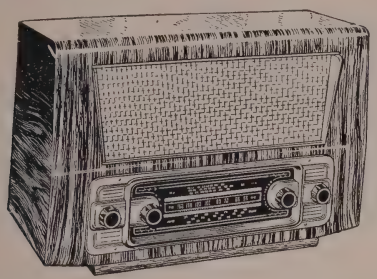
Adding to the comprehensive range of ULTIMATE radios are two new models recently released. They add distinction to an already outstanding range of models, and it is confidently anticipated that both these models will be sales-winners. The new releases are a 6-valve broadcast mantel and a very fine low-boy which houses a 7-valve bandspread chassis.

6-Valve Broadcast Mantel "Tyne"

A really smart mantel in a highly polished veneered cabinet which will add distinction to any home. This

cabinet design is based on a European trend, and the walnut veneers, with their rich graining, contrast very pleasantly with a gold grille cloth and light wood trims on each side of the speaker baffle.

The receiver is a 6-valve broadcast, one of the few in this class on the market today. Complete with an R.F. stage, this receiver is ideal for places where reception is difficult, but, wherever it goes, it gives powerful, tone-pleasing performance.



The speaker is a Rola 6-9H and, with the designed cabinet to augment it, gives lifelike tone that makes an immediate good impression.

The set is fitted with extension speaker and gramophone input jacks, which materially increase the versatility of this set. A fine performer, backed by a fine name, with the finest of reputations.

Specifications

Valves: 6BA6 R.F. amp.; 6BE6 freq. changer; EF41 I.F. amp.; 6AV6 second det.; EL41 power amp.; 6X4 rectifier.

Speaker: 6-9H Rola.

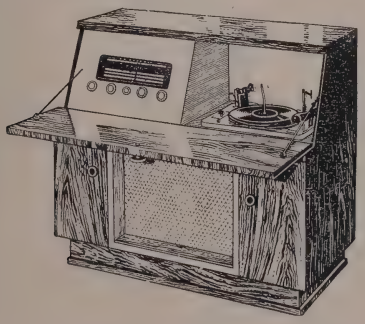
Cabinet: Highly polished walnut veneers, with light wood trims.

Dimensions: 20 in. long; 12½ in. high; 8¾ in. deep.
Jacks: Gramo. input and extension speaker.

Price: £35 12s. 6d.

Manufactured and distributed by Ultimate-Ekco. (N.Z.) Co. Ltd., P.O. Box 1166, Auckland.

7-Valve Bandspread Lowboy "Symphony"



"A truly magnificent lowboy," said the thousands of people who saw the prototype of this model at the last Auckland Easter Show. Built after the bureau style, the cabinet is of walnut veneers and features a really outstanding main panel of matched butt grainings. Ample record storage is provided by two record cupboards, and finishing touches are added by a nicely patterned grille cloth and classy Turner knobs.

This lowboy is yet another ULTIMATE to use the three-speaker network, pioneered in New Zealand by the manufacturers of this radiogram. True, life-like tone, balanced and pleasing, yet with sufficient variation to satisfy the most diverse demands, is a feature of this great performer.

The quality built chassis employs an up-to-date circuit, and uses high-quality components selected to give long service. A hi-fi switch gives an extended tonal range, particularly valuable for reproduction of recorded music.

This set has already gained for itself an enviable reputation for outstanding appearance, outstanding performance, and attractive price.

Specifications

Valves: 6BA6 R.F. amp.; 6BE6 freq. changer; EF41 I.F. amp.; 6AV6 second det.; EL41 power amp.; 6X4 rectifier; 7B7 pre-amp.
Output: 3½ watts approximate.
Speakers: 3-speaker network.
Cabinet: Matched figured walnut.
Dimensions: 38 in. long; 33 in. high; 18 in. deep.
Gram. unit: 3-speed automatic.
Price: £145.

Manufactured and distributed by Ultimate-Ekco (N.Z.) Co. Ltd., P.O. Box 1166, Auckland.

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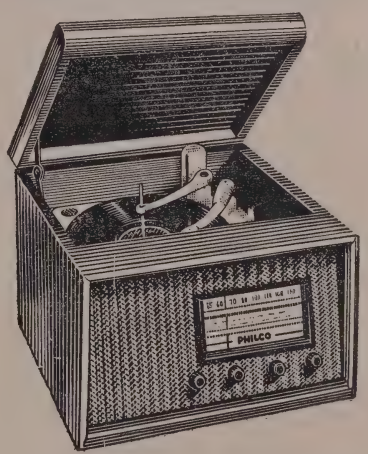
PHILCO MODEL 1242



A most interesting new Philco release is Model 1242, a mantel radiogram in solid oak, retailing at £39 10s. Model 1242 is fitted with the latest Collaro RC54 fully mixing three-speed record-changer, and gives full broadcast coverage from 535 to 1620 kc/sec.

A handsome easy-to-view dial scale is illuminated by combination edge and flood lighting and the names of all New Zealand and favourite Australian stations are engraved on the scale for easy location of programmes. Employing a continuously variable tone control, Philco Model 1242 performs exceedingly well and is capable of unusually rich bass and brilliant treble tones. The distinctive oak cabinet in the modern trend is available in no fewer than three finishes—dark oak, medium oak, and blonde.

Philco distributors are Russell Import Co. Ltd., P.O. Box 102, Wellington; P.O. Box 9038, Auckland; and P.O. Box 1871, Christchurch.

TRADE WINDS

ROLA ACTIVITIES IN AUSTRALIA

Part of the Horizontal Output Transformer Winding Section in the newly established TV Components Division at Rola Company's Richmond Plant.

Fresh from a brief visit to Melbourne, Mr. H. Brown of Loudspeakers (N.Z.) Ltd., has returned full of enthusiasm about Rola activities in Australia.

The new wire factory at Harrisville is now in full production, he reports.

At the Richmond factory, besides the normal production of speakers, magnetic alloys, etc., manufacture of TV components is now in full swing. We learn that, to fit in with TV requirements, the tendency with regard to speaker production now is to change the few remaining models with a ring magnet assembly over to centre block assembly, thus removing extraneous fields which affect TV reception.

Pictured on this page are views of the production line in various parts of the Rola factory at Richmond.

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SILVER MEDAL FOR PETER SCOTT, C.B.E., D.S.C.

The Television Society's silver medal, instituted in 1948 for rewarding outstanding artistic achievement in television has this year been presented to Peter Scott, C.B.E., D.S.C. (Hon. Director of the Wildfowl Trust).

The award was presented at the Society's annual dinner on 19th March by the President, Sir Vincent de Ferranti, in the presence of more than 275 members and guests. Previous recipients of the medal, which is awarded annually, are:

1948—Mr. George More O'Ferrall.
1949—Mr. Algernon Blackwood.
1950—Miss Annette Mills.
1951—Miss Joan Gilbert.
1952—Mr. Eric Robinson.
1953—Mr. George Cansdale.
1954—Mr. Donald Smith.
1955—Dr. Glyn E. Daniel.

* * *

A "BLOW" FOR T.V.

For the first time a permanent television camera has been installed in a wind tunnel to enable scientists to watch the behaviour of aircraft models undergoing test in faster-than-sound conditions.

The Duke of Edinburgh recently officially opened the wind tunnel of the Aircraft Research Establishment at Bedford. Owing to the unique design of this tunnel, which is among the most advanced in Britain, conventional observation is impossible and a Pye Industrial Television camera has been installed in the inner wall of the tunnel and is aimed at the model under test.

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MR. L. HEPBURN — CHRISTCHURCH

The sympathy of all members of the radio and electrical trade goes to Mr. L. Hepburn, popular proprietor of Tricity House, Christchurch, who recently suffered severe leg injuries in a train accident.

Knowing his valiant spirit, we cannot believe that even a shattered knee-cap will shackle him for too long, and we hope that his cheerful presence will soon once more be a prominent feature of the radio and electrical trade in Christchurch.

Checking the Inductance of Deflection Yoke Coils in the newly established TV Components Division at Rola Company's Richmond Plant.

ENGLISH PRAISE FOR WAIHI FACTORY

"Our factory at Waihi is a perfect example of the sort of factories we like to run in England." So said Mr. C. O. Stanley, chairman of Pye Ltd., Cambridge, England, on a recent visit to New Zealand. Mr. Stanley, who came to New Zealand for discussions with Mr. G. A. Wooller, Managing Director of the local Pye Company, went on to say that, wherever possible the factories in England were established in small communities.

Mr. Stanley said, "In this way people become much more interested, and they have their roots in their own place and community. In England Pye have 32 factories and of those 12 are what we call 'village industries'. In the little village of Linton, for instance, we have a factory that does nothing but make crystals. Our factory employees are 200 girls and we don't get 1% turnover of labour. The staff becomes highly skilled, and today Pye have an international reputation for the crystals that come out of that little plant."

Mr. Stanley continued by saying that the small country town is the sort of place that interests Pye. "That is why in a town like Waihi we feel we are part of the place; we are important to it; the people think of it as their factory and tend to be proud of what it does. It is much more to them than just getting a week's wages."

* * * *

FESTIVAL PRESSING IN NEW ZEALAND

A quicker service for dealers in the supply of American Decca, Coral, and Brunswick 78 r.p.m. "pops" is announced by G. A. Wooller & Co. Ltd. This results from a new pressing service Festival have set up in New Zealand following their acquisition of the complete rights to Decca Inc., U.S.A., Coral Inc., U.S.A., and Brunswick Records, U.S.A. This new service in New Zealand is part of a general expansion in the Festival set-up. In Australia, £100,000 has already been allocated to provide the new accommodation and plant required by the vast increase in business that can be expected.

G. A. Wooller & Co. Ltd., who, of course, handle Festival in New Zealand, will shortly have the new pressing service fully established, and dealers can expect a full supply of first-class "pop" numbers from the catalogue of Decca Inc., U.S.A., Coral Inc., U.S.A., and Brunswick Records, U.S.A.

Long-playing discs from these catalogues will also be available as before from G A. Wooller & Co. Ltd., as will discs from these other famous companies: Westminster and Vox, of U.S.A.; Bell, of U.S.A.; and Metronome, Sweden; and, of course, original Festival discs.

Prophecy is dangerous, but we feel safe in saying that these changes are going to make a big difference to the record market in New Zealand, to the profit of dealers and public alike.

* * * *

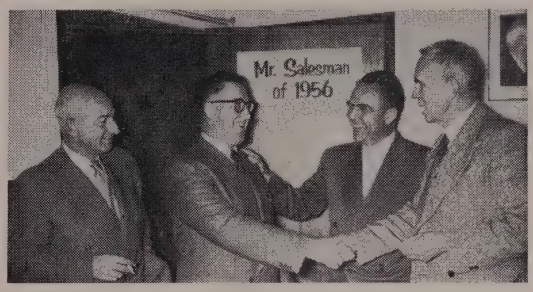
NEW OFFICES FOR PYE—AGAIN

If Pye Ltd., with their associate company, G. A. Wooller & Co. Ltd., seem a little unstable in the matter of premises, it is only because the expansion of the two companies has been consistently faster than could be anticipated. The new expansion includes the taking over of offices on the 5th floor of Chancery Chambers, where Pye some time ago acquired office and showroom space in the basement. Mr. Wooller's office, with much of the administrative section, remains on the 4th flooor of Chancery Chambers in Chancery Street, Auckland, but the lease of the John's building just opposite, which previously belonged to Swan Electric, has been taken over by Pye.

A ground-floor storeroom in John's Building is a big advantage, and makes room for more offices in Chancery Chambers. The total floor space now devoted to Pye and Wooller offices and showrooms is in excess of 12,700 square feet.

★

PHILIPS PRESENT AN "OSCAR"



Recently the editor of R. & E. R. attended a happy little gathering at the Philips head office when Mr. Leighton Lord, the Company's Managing Director, presented Mr. Bill Anderson with the first Philips' "Oscar" for the current year.

During the presentation Mr. Lord said "We do not believe there are any 'super-salesmen'. To our way of thinking a super-salesman is merely a diligent and intelligent good salesman who continues to achieve his objective under all conditions and situations. His objective is to sell and he always remembers the adverse economics of 'not selling'."

Mr. Lord was pleased to recognize Bill's achievement in a practical way and apart from the Philips' "Oscar", which in this instance was a beautiful piece of Dresden china, a handsome cheque was handed over.

Our congratulations go to Mr. Bill Anderson for becoming the star salesman for 1956.

FOR THE TECHNICIAN

SERVICING INSTRUCTIONS FOR THE H.M.V. DOMESTIC WRINGER WASHER, SENIOR 35—PART 2

LID, AGITATOR AND AGITATOR COLUMN ASSEMBLY

Parts Numbers:

Part No.	Description	No. Reqd.
517A	Agitator column assembly	1/A
51071	15-tooth pinion	1
51072	Tug pin for pinion	1
51073	Agitator shaft	1
51074	Bearings	2
51075	Washer (fibre)	1
51080	Column	1
51028	Lid	1
51029	Rubber for lid	1
51046	Bolts	4
51077	Agitator	1
51078	Cap for agitator	1
51082	Gasket	2

Service Hints and Service Remedy

1. To remove Agitator Column Assembly Part No. 517A for inspection and service, withdraw Agitator Part No. 51077 and proceed as in Service Hints for Bowl, Shroud, and attached parts, Section A, B, and C.

Then punch Tug Pin Part No. 51072 fixing 15-tooth Pinion Part No. 51010 to Agitator Shaft Part No. 51073, which can now be withdrawn from Tube Assembly Part No. 51080.

The only part liable to require replacement in service at any time will be the 15-tooth Pinion Part No. 51071. This part must always be replaced at the same time as Rack Part No. 51070 is serviced in Main Gear Box.

Reverse procedure for reassembly of Agitator Column Assembly. Always check Gasket No. 51008 before replacing Agitator Column Assembly into Washer.

MAIN GEAR BOX ASSEMBLY

Parts Numbers:

Part No.	Description	No. Reqd.
519A	Gear box assembly complete less motor	1/A
519AM	Gear box assembly complete with motor	1/A
512A	Control arm assembly	1/A
515A	Worm and spindle assembly	1/A
516A	Worm wheel assembly	1/A
515AB	Worm and spindle with bearing and seal assembly	1/A
51017	Spring	1
51040	Bolts	3
51047	Gear box body	1
51054	Worm bearing	1
51055	Gasket	1
51062	Shroud collar	1
51063	Tug pin for shroud collar	1
51067	Crank pin	1
51068	Connecting rod	1
51069	Gudgeon pin	1
51070	Rack	1
51083	Sliding guide for rack	1
51086	Control arm collar	1
51087	Lock screws	2
51088	Lock screws	1
51089	Control lever	1
51092	Filler plug	1
51093	Gear box cover	1
51094	Gasket	1
51095	Cover screws (short)	16
51096	Spring washers	19
510113	Lock screws	1
510114	Water pump mount bracket	1
510115	Cover screws (long)	3
510129	Nameplate	1
510130	Drive screws	2
510133	Oil seal	1
510134	Plunger	1

Service Hints and Service Remedy

Persistent Oil Leaks

1. Oil leaking at Gland on machines prior to Serial No. 3285 is serviced by replacing old type Worm and Shaft Assembly and Worm Bearing with Gland Nut, with modified Worm and Shaft Assembly Part. No. 515A and Worm Bearing Part No. 51054 with Neoprene Seal Part No. 51133. This modification will effectively remedy the trouble at this point.

2. Oil leaking past Oil Seal Part No. 51133 through this part having worked out of Worm bearing Part No. 51054. Cause in this case is through the crushing of the Oil Seal Part No. 51133 in fitting because of excess pressure being exerted.

Remedy: A new Seal Part No. 51133 must be fitted. Extreme care must be exercised when installing new Neoprene Seal into Bearing and proper Seal Fitting Tool Part No. STO1 should be used.

3. Oil leaking from Bottom Plate of Main Gear Box. Check for broken Gasket Part No. 51094.

General procedure to service Main Gear Box for oil leaks at Bottom Plate is as follows:—

(a) Extract oil from Gear Box through Filter Plug by using special Oil Syringe Part No. ST04.

(b) Tip machine right upside down.

(c) Remove Water Pump Assembly Part No. 518A.

(d) Remove Gear Box Bottom Plate No. 51093 after first having removed Chassis Cross Members from washer.

(e) On Washer with old style heavy Bottom Plate on machines prior to Serial No. 4276 check carefully and thoroughly for warping. Should this be the case replace with modified Bottom Plate (pressed type) Part No. 51093, using new Gasket Part No. 51094. Re-

assemble by reversing above procedure and refill gear box with approximately one half gallon of special Scott Washer Lubricant obtainable only from J. & A. P. Scott Ltd.

Intermittent Knocks:

1. Intermittent knocking in main gear box when agitator engaged, with knocking increasing in intensity during washing cycle as machine warms up.

Remedy: An alteration in main gear box lubrication at Serial No. A6893 has eliminated practically all main gear box knocking.

To service No. 1 trouble we recommend that main gear box, where knocking trouble occurs prior to Serial No. A6893, be emptied and refilled with new Scott Main Gear Lubricant D140 procurable only from the factory. This should satisfactorily cure the trouble.

2. Excessive end clearance between Gear Case Part No. 51047 and Worm Wheel Assembly Part. No. 516A.

Remedy: Fit special Spacing Washer available from manufacturers.

3. Worn Rack Part. No. 51070.

Remedy: Fit new rack Part No. 51070 together with new 15-tooth Pinion Part No. 51071. Never fit new Rack without new 15-tooth Pinion Part No. 51071.

Service procedure for both the above operations:

(a) Remove lubricant from gear box.

(b) Turn washer upside down.

(c) Remove cross members from chassis.

(d) Remove bottom plate.

(e) Check for 1 and 2 troubles.

To remove Worm Wheel Assembly Part No. 516A first remove Wringer Drive Tube Part No. 51023 and Wringer Bracket Part No. 51021. Drive out Tug Pin Part No. 51061, remove Collar Part No. 51062, and withdraw Worm Wheel and Shaft Assembly Part No. 516A after removing Worm and Shaft Assembly Part No. 515A. To remove Worm and Shaft Assembly Part No. 515A, remove Worm Bearing Part No. 51054 by unscrewing three Worm Bearing Screws, first having removed Motor Coupling Part No. 51051. When withdrawing Worm Shaft Assembly Part No. 515A, be careful not to lose Thrust Pad No. 51134 and Spring Part No. 51017. Fit special Spacer to Worm Wheel and replace all parts by reversing above instructions. Rack can be removed at same time by unscrewing crank pin Part. No. 51067 and withdrawing Connecting Rod and Rack Assembly. Remove Rack by driving out Gudgeon Pin Part No. 51069.

4. A further possibility of intermittent knock could be through end play between Worm Wheel Part No. 516A and Worm on machines fitted with old style Worm without end Thrust Pad.

Remedy: Replace Worm with modified Worm and Shaft Assembly Part No. 515A.

Noisy Gear Box:

Check Worm Part 515A for marks and imperfections or excessive wear. Replace if necessary. Should knocks or noise not be eliminated, replace complete Gear Box Assembly Part No. 519A.

(To be concluded)

ANNUAL REPORT—NEW ZEALAND RADIO AND ELECTRICAL TRADERS' FEDERATION

Presenting his annual report to the Conference of the New Zealand Radio and Electrical Traders' Federation held at Wanganui on 21st May, 1956, the President, Mr. A. K. Griffiths, commented that price margins in most cases have risen to reasonable proportions on radio receivers. The condenser question remains, though searching inquiry has revealed little matter for real complaint. The Board of Trade, said Mr. Griffith, appears to be "bored" with trade!

The Radio Interference Standing Committee has at last produced a provisional standard, and will shortly consider a revised draft of the Radio Interference Regulations implementing the new measures, before forwarding same to the Government for action.

The Federation has been extremely active on the question of Power Board Trading and much time was devoted by Messrs. Barwick and Hallett to the preparation of authenticated nett profit figures for all Power Boards over a period of 10 years, 1945-55, together with a graph showing the phenomenal increase in these profits. Approaching the matter from the Income Tax angle, a full deputation from the Traders' Federation, led by Messrs. Hallett and Barwick and including representatives of the Associated Chambers of Commerce, the New Zealand Electrical Traders' Federation and the Home Appliance Group of the New Zealand Retailers' Federation, met the Minister of Finance, Mr. Watts, who proved most co-operative and indicated his intention of taking the matter further.

The ultimate advantage to individual members of Federation action on such questions as this, clearly demonstrates the value of Federation membership, and it is hoped that many non-member traders will signify their appreciation by joining up with their local associations and thus increasing the strength of the Federation.

In all, said Mr. Griffiths, the past year has been full of incident and activity, and thanks to the wonderful co-operation of the Executive Committee and in particular the Vice-President, Mr. N. Hallett and the Secretary, Mr. I. Archibald, the Federation can show a very healthy credit balance in achievement.

8-Valve Radiogram

(Continued from page 24)

to be dissipated is that coming directly from the valves.

The reason for using a separate filament transformer is that, with eight valves, some of which have heavier heater currents than is usual these days, the heater winding of the main power transformer would be loaded past its rated limit. Also, using the additional transformer means that both transformers are running reasonably lightly loaded, and this again means less heat developed in and above the chassis.

ALIGNMENT

As is usual with a receiver of this kind, the alignment of the I.F. transformers should be done in the "Narrow" position. If a frequency-modulated oscillator is available, this should be used, as it will enable the transformers to be touched up in the broad position, so that the pass-band is quite symmetrical. However, quite acceptable results can be obtained simply by aligning the transformers by signal generator and output meter in the narrow position, thereafter taking what one gets in the broad position.

Alignment of the R.F. end is no different from any ordinary five-valve superhet, with the padder adjusted at the low-frequency end of the dial and the trimmers at the high-frequency end. If a signal generator is not available, alignment can be done with an output meter only, relying on signals off the air instead.

NEECO RADIANT HEAT ELECTRIC RANGES

Consort

Low price, advanced features.

The name they know... The product they can trust *Sovereign*

Medium price range, popular choice.

Consistent advertising, dependable products and fair dealing have established Neeco as New Zealand's leading manufacturers of electric ranges. With a Neeco you're half way to a sale before you start!

Ensemble

"Eye-level" cooking, fully automatic.

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just a minute .

On the left: ONE of our automatic lathes makes any ONE of these parts at the rate of 1 per minute—on the right at the rate of 20 per minute. With many lathes in many minutes we can and do produce millions. The point is, combining speed with absolute accuracy, AUTO MACHINES are able to produce component parts, faster, better and more economically priced.

AUTO MACHINE MANUFACTURING CO. LTD.

18–20 Nelson Street. :: C.P.O. Box 179.
Tel.: 31-638, Auckland.

A.A

Missing and Stolen Radios

(Continued from page 37)

Patea:

Radiola 1956, 5-valve mantel radio, serial No. either 93195 or 9319S; maroon cabinet, white round-faced clock with gold edgings, 3 in. dial, Arabic figures; 2 feet plastic cord attached.

Marton:

Bell 5-valve mantel radio, serial No. 20483, in brown plastic cabinet.

Lower Hutt:

Philips battery/electric radio, model 545; greenish grey cabinet.

Wellington:

Pacemaker 5-valve portable radio, serial No. 27806, maroon and ivory cabinet with crack in front lid and broken back.

Clipper 6-volt car radio, model C.R.55. Grey cabinet.

Pacemaker 12-volt car radio converted to short-wave receiver; speaker fitted with switch to operate second speaker; brown colour.

Philips 5-valve dual-wave radiogram, serial No. 61192; light brown walnut cabinet with swing dial and large speaker above dial; top of cabinet lifts up.

Grundig Model TK5 portable tape recorder, serial No. 32389; grey cabinet.

Radiola clock radio, serial No. 52689; grey plastic cabinet with cream front and oblong dial; circular clock face above dial; speaker left front.

Pye Model PZ.71, 5-valve, dual wave, A.C. mantel model radio, serial No. 45892; brown plastic cabinet 15 in. x 12 in. x 7 in. Short wave, broadcast, volume and tuning switches on cabinet front and wave band switch right side.

Pacemaker portable radio, serial No. 18132; maroon and white plastic cabinet.

Columbus 5-valve, Model 509, serial No. 23462; wooden cabinet with perpendicular dial.

Christchurch:

Columbus 12-volt car radio, model V.15, serial No. 6964;

Bell 5-valve broadcast radio, serial No. 1099; off-white cabinet 12 in. x 6 in. x 6 in. with oblong dial and two white tuning controls.

Pacemaker portable radio, serial No. 53523, royalty number 16176; ivory coloured cabinet.

Pacemaker portable radio, serial No. 53584, royalty number 116337; burgundy coloured cabinet.

National 5-valve tablegram; medium brown cabinet, lift-up lid, one-speed, plastic dial surround missing.

Auckland:

Ultimate battery/electric portable, serial No. 167712; dark brown mottled plastic cabinet 14 in. x 12 in.

It's here! NEW

FOOD CRAFTER

by Westinghouse

Thumb-tip Beater Ejector . . . just touch the button . . . and zipp, out come the beaters.

Mix Dial Up Front . . . swift—visibility of six basic speeds—plus twenty variations.

Merry-Go-Round Bowl . . . assures all ingredients are brought in to beaters for a complete mix.

Pitcher-type Juice Crafter . . . gets ALL the juice! Made of transparent plastic. Graduated in ounces.

Now in Glorious COLOURS

PRIMROSE,
PASTEL GREEN
CORAL PINK,
and WHITE.

RETAIL PRICE:

£21/5/-

Optional extras:
JUICE CRAFTER

(MEAT GRINDER available shortly).

The latest from Westinghouse, America, new FOOD CRAFTER far surpasses other conventional mixers in greater usability, mixability and power. FOOD CRAFTER bakes cakes lighter than a cloud . . . because the constant, even beating ensures a finer-textured mix. FOOD CRAFTER is styled to that American elegance which proves practical things can be beautiful and makes instant eye appeal to your customers. FOOD CRAFTER is as rugged as a work horse, power to spare for even the heaviest mix—no slow-down, no stop. FOOD CRAFTER Never NEEDS OILING . . . life-long lubrication is sealed in. Stock and recommend Westinghouse FOOD CRAFTER.

YOU CAN BE SURE..IF IT'S Westinghouse

Available from **H. W. CLARKE [N.Z.] LTD.** Branches throughout N.Z.

Perfect Record Reproduction for the Critical Listener!

COLLARO

Model 2010 Transcription Unit

Model 2010 is mounted on a rectangular unit plate and is equipped with a STUDIO "PX" High Fidelity pick-up head, comprising a special low resonance arm and special bearing.

HIGH FIDELITY AT LOW COST

TURNTABLE — specially balanced non-magnetic turntable with a weight of approximately 8½ lb. and is fitted with a rubber turntable mat. The weight of the turntable is so disposed that the majority of the weight is at the periphery, thus giving a flywheel effect.

MOTOR—available for A.C. voltages of 200/250 volts at 50 cycles per second. Silent running and with absolutely "wow"-free performance.

THREE-SPEED GEAR—an entirely new type of 3-speed mechanism has been designed to give absolutely uniform turntable speed, while improved technique in the construction and assembly of the motor ensures reproduction free from rumble and frequency modulation.

PICK-UP—it is fitted with a tubular metal arm which has a very low resonance, and the arm is so designed as to be capable of playing 16-inch records. The pick-up insert is housed in a new attractive head moulding which is fitted with finger-tip control to enable the pick-up to be placed accurately and carefully on the record. An adjusting screw is fitted to the unit plate adjacent to the pick-up base to give free suspension of pick-up support.

SPEED CHANGE AND "OFF" SWITCH—conveniently situated on the right-hand side of the unit plate. There is an "OFF" position between each speed. Switching the unit from one speed to another automatically switches off the motor during the speed change. Switching to any speed automatically starts the motor.

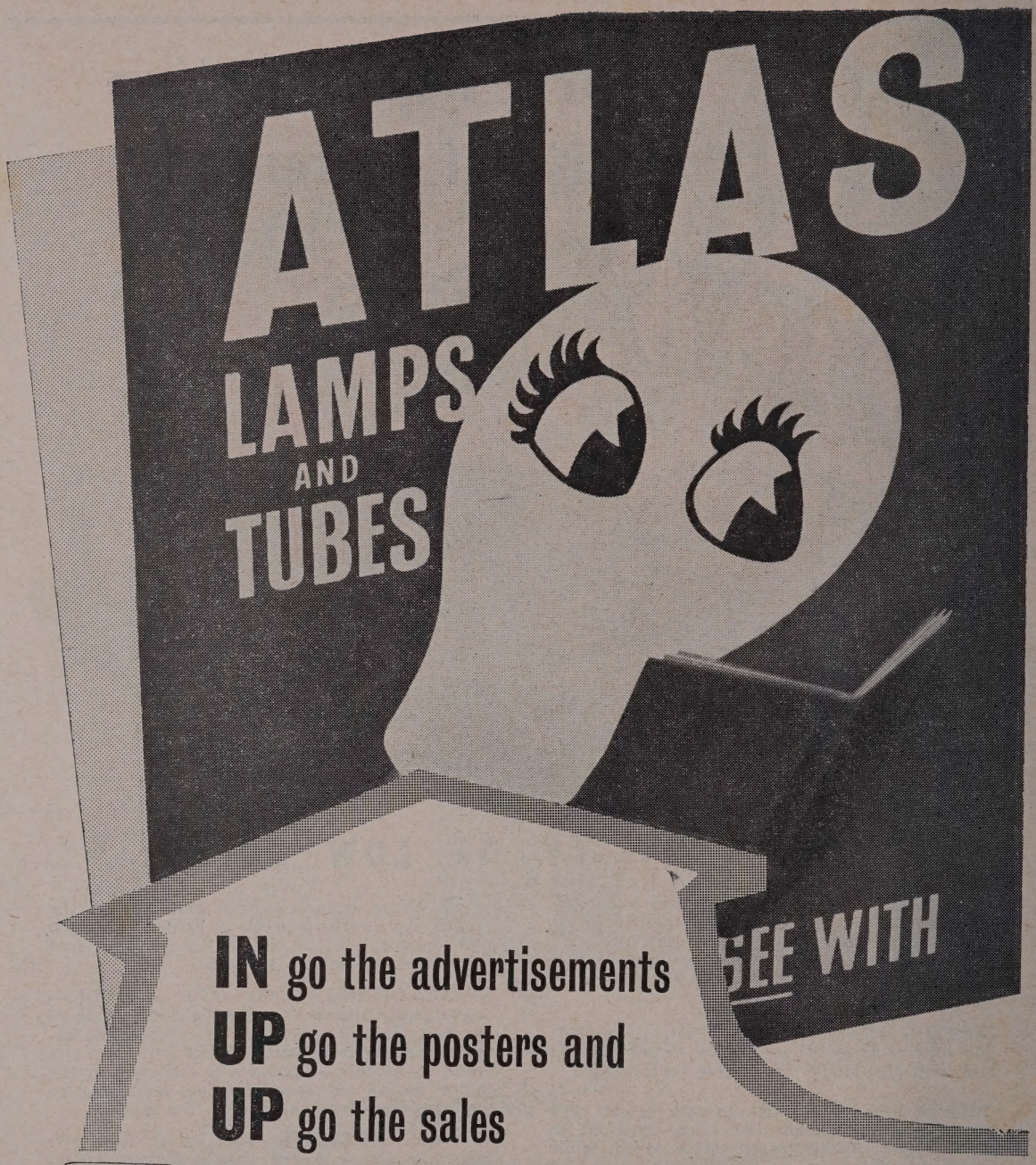
45 r.p.m. ADAPTOR—This adaptor is permanently spring-loaded on the turntable and no other fittings are required for playing 7-inch 45 r.p.m. records with large centre holes.

Model 2010, with "Studio" Px Pickup,
£20 4s. Retail

Model 2010, without Pick-up,
£15 8s. 6d. Retail

FOR FURTHER INFORMATION, INQUIRE FROM THE NEW ZEALAND DISTRIBUTORS:

RUSSELL IMPORT CO. LTD. P.O. BOX 102 WELLINGTON



IN go the advertisements
UP go the posters and
UP go the sales

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PROMINENTLY IN YOUR WINDOW
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Complete range of Continental types available for immediate delivery:—

AZ41	EL41
DK40	EL84
EAF42	UAF42
ECH42	UBC41
EBC41	UCH42
ECH81	UL41
EF41	UY41

etc., etc.

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Made by the most famous of all German Electronic equipment manufacturers, Telefunken Tubes are impressive examples of German technical skill and efficiency developed over half a century! It is literally impossible to buy tubes of higher quality—yet they cost no more than ordinary run-of-the-mill tubes.

In stock now and ready for distribution throughout New Zealand.

Also available from A.W.A. and NEECO —immense stocks of A.W.V. Radiotron and R.C.A. tubes covering a complete range of American series makes.

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P.O. BOX 830, WELLINGTON. P.O. BOX 1363, AUCKLAND
P.O. BOX 2084, CHRISTCHURCH.

AND AVAILABLE FROM: NATIONAL ELECTRICAL & ENGINEERING CO. LIMITED
(ALL BRANCHES)

Goodmans

AXIOM *Loudspeakers*

SOUND REPRODUCTION FOR HIGH FIDELITY

OTHER MODELS INCLUDE:

AXIOM 80 (6 watts)

The extended frequency coverage from 20/20,000 c.p.s. in free air has been achieved by the patented Duplex Cantilever (free suspension) cone assembly.
Brief Specification:

Frequency Coverage ..... 20/20,000 c.p.s.
Fundamental Resonance ..... 20 c.p.s.
Flux Density ..... 17,000 gauss
Net Weight ..... 9 lb. 6 oz. (4.2 Kgs.)
Impedance ..... 15 ohms

AXIETTE (5 watts)

A single-cone unit with an extremely well-balanced frequency coverage — ideal for small rooms.

Brief Specification:

Frequency Coverage ..... 40/15,000 c.p.s.
Fundamental Resonance ..... 65 c.p.s.
Flux Density ..... 13,500 gauss
Net Weight ..... 3 lb. 4 oz. (1.47 Kgs.)
Impedance ..... 3 or 15 ohms

ILLUSTRATED:

AXIOM 150 MK II 12 in.

A full range High Fidelity reproducer with a power handling capacity of 15 watts.

Brief Specification:

Frequency Coverage ..... 30/15,000 c.p.s.
Fundamental Resonance ..... 35 c.p.s.
Flux Density ..... 14,000 gauss
Net Weight ..... 12 lb. 13 oz. (5.8 Kgs.)
Impedance ..... 15 ohms

AUDIOM 60 12 in.

A versatile single-cone 15 watts loud-speaker, available with bass resonance of 35, 55 or 75 c.p.s. The two former are particularly suited for High Fidelity Crossover Systems with AXIETTE as Treble unit.

Brief Specification:

Flux Density ..... 14,000 gauss
Total Flux ..... 158,000 maxwells
Net Weight ..... 12 lb. 13 oz. (5.8 Kgs.)
Impedance ..... 15 ohms

FULL DETAILS OF ALL MODELS FROM SOLE NEW ZEALAND AGENTS:

TURNBULL & JONES LTD.

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